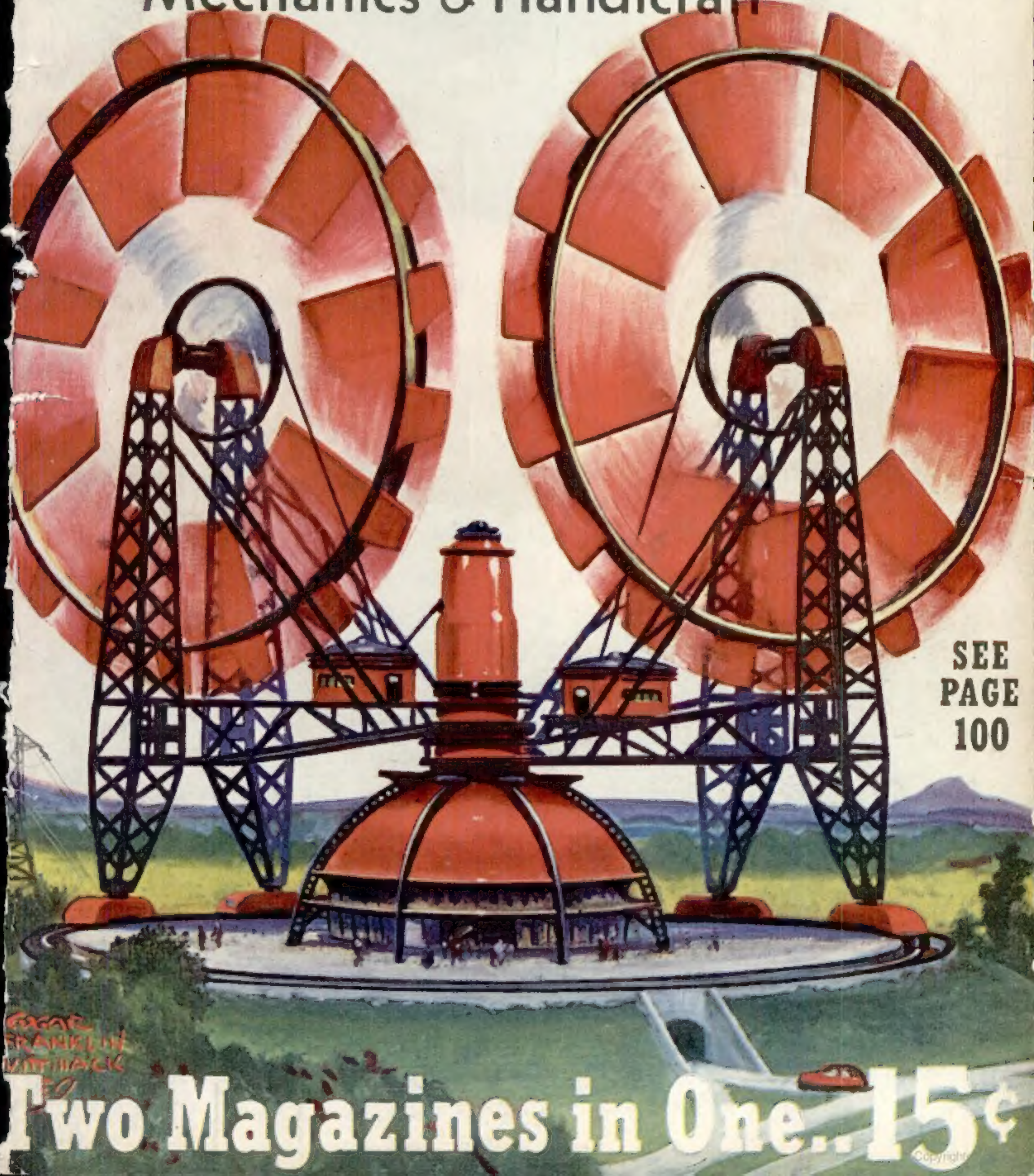


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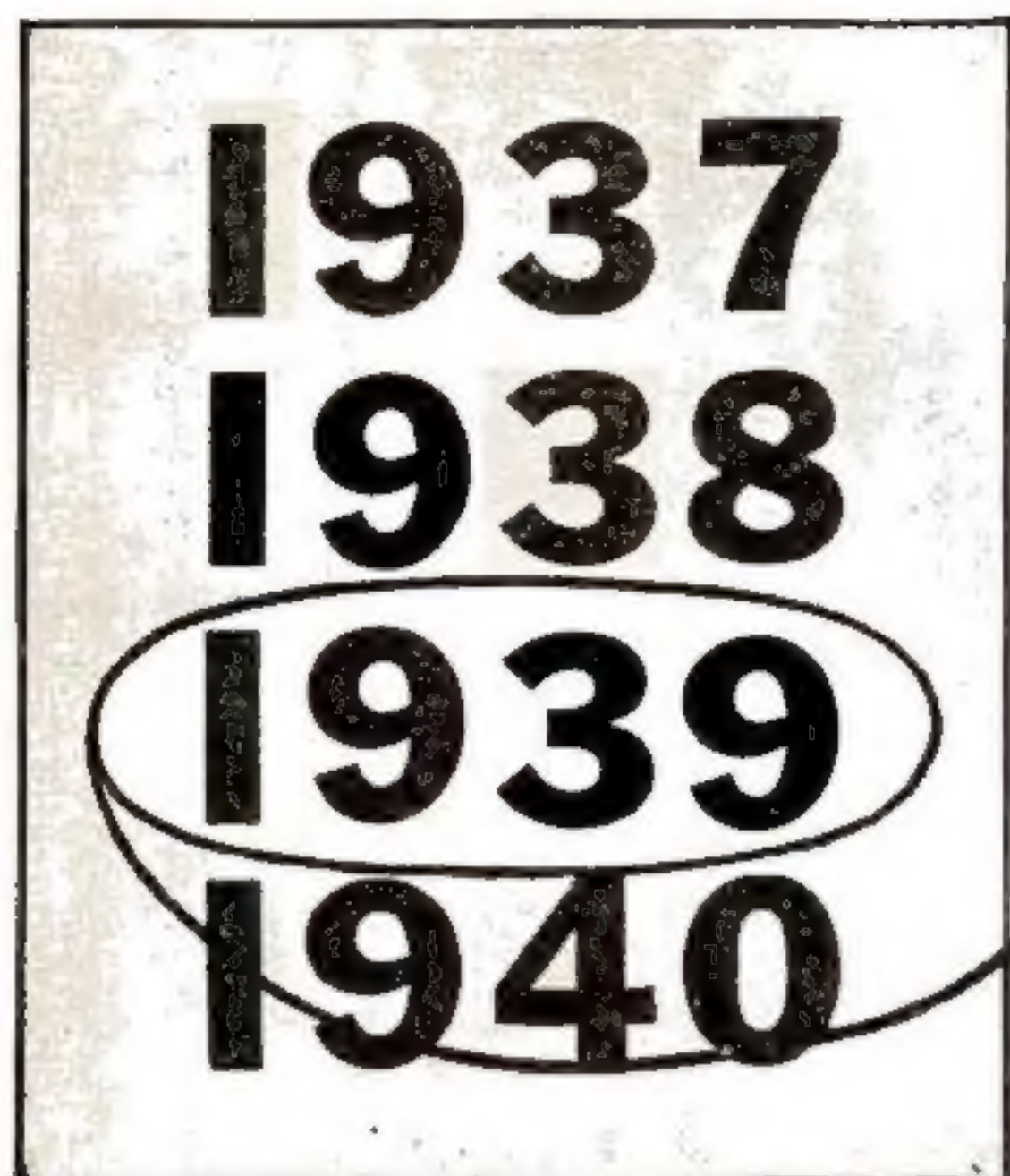
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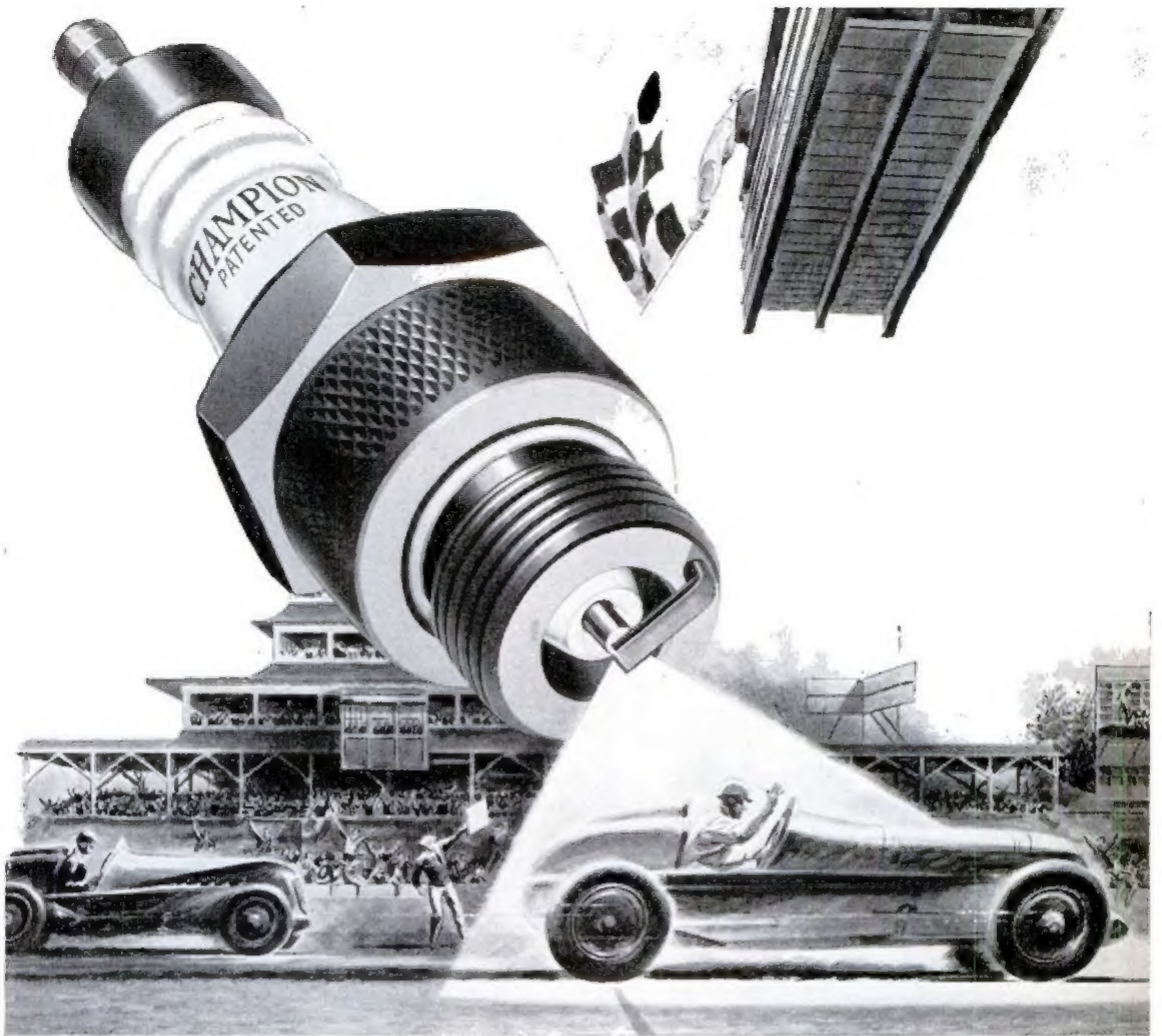
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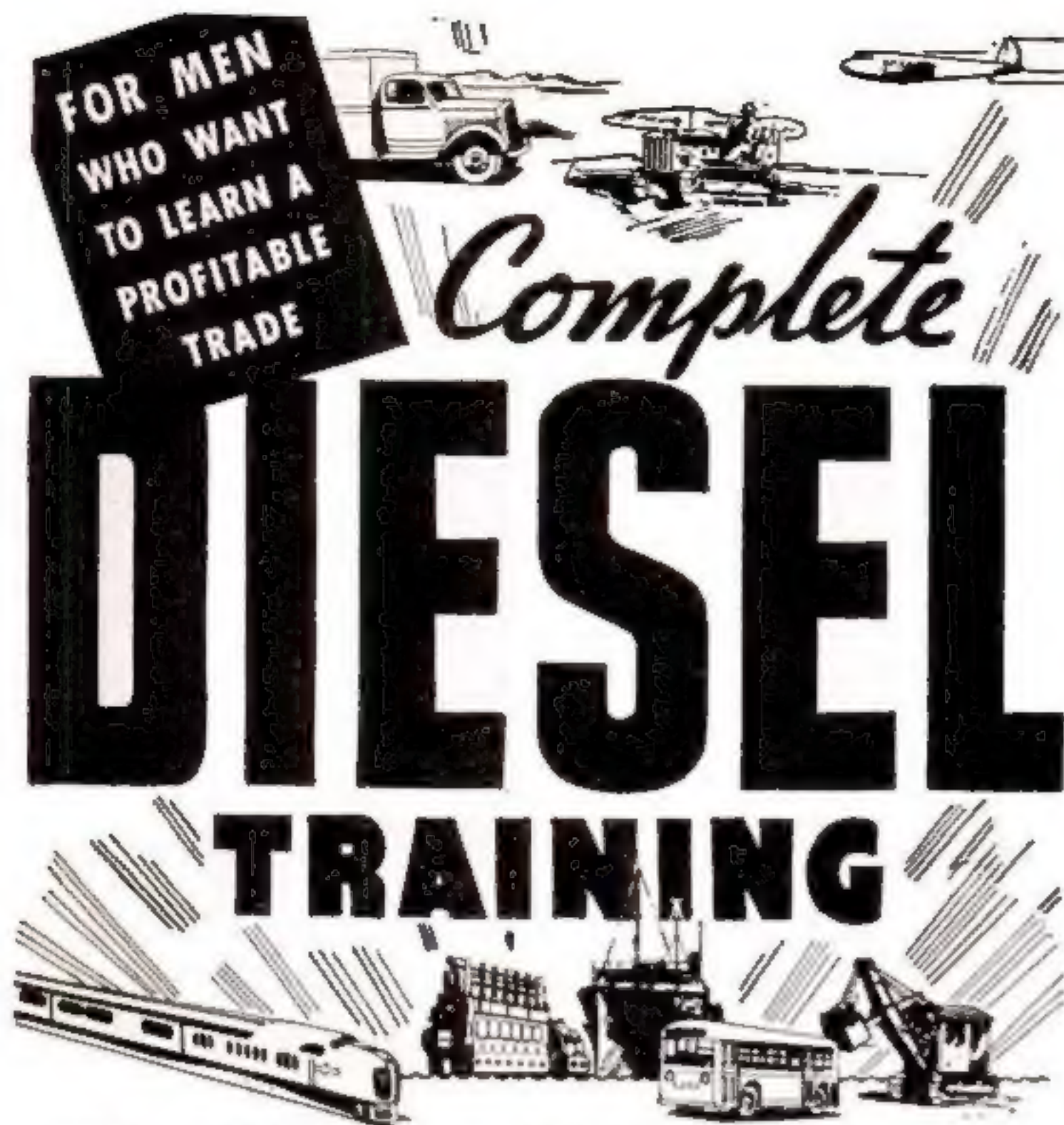
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To Ambitious Bookkeepers and Junior Accountants— ARE YOU GETTING AHEAD THE SPEEDY WAY



—OR THE SLOW WAY?



Here's how you can find out! Answer these questions:

- Do you know why the management asks for each set of figures that you prepare?
- Do you see clearly how those figures will shape company policies?
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- In short, is your day-to-day work *full of meaning* to you or is it just humdrum routine?

YOUR answers to those questions would give an experienced personnel man a picture of your entire future!

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But LaSalle can, and does, make your study interesting—easy to understand—*useful right on your present job*—if you will do *your* part.

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Over and over, you find such phrases as: "Then came my second raise"—"So then they made me manager"—"That first increase completely paid for my training the first two months."

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Position.....Firm.....

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The man with only grade school education starts at \$400 a year, averages only \$1,265 a year over a period of 40 working years. Today no ambitious man need be chained

down to low pay by grade school education. In your own home you can get expert help and complete your high school course or prepare for drafting, Diesel, air conditioning, etc., and get ready to earn more money.*

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I graduated from high school in June, 1936, and in October, 1937, enrolled in your Engineering Course just a little over a year ago; and I am writing you today telling you of the wonderful things which have happened to me since that day when I enrolled. I have studied hard and consistently and according to your instructors have earned good grades and have progressed rapidly. This rapid progress has been made possible by the methods "American School" uses and the splendid manner in which your instructors handle any special inquiries or problems which may confront the student.

Very recently I did the major part of the Designing, Drawing and Detailing of a device which has been patented by one of the world's leading automotive truck manufacturers. This device is being used now by the Motor Truck Corporation and they have made the statement that it saves them \$13 on every unit they produce. I will not be 21 years of age until next Spring and expect by that time to have completed my course and have my "American" diploma which I will be mighty proud of. — EDWARD H. MCCLELLAND, Cleveland, Ohio.

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not only has bigger jobs open to him, but he can go on to college, prepare for teaching or other professions, or for leadership in business or industry. High School education definitely increases your opportunities for advancement and your earning ability!*

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From a practical standpoint I can truthfully say that my study of the course accomplished for me all I ever hoped it could and even more. As evidence of this, I submit the fact that at 30, I am now employed as auditor and accountant in a position of trust at compensation more than double what I was receiving at the time of my enrollment. — L. V. PEART, Ogden, Utah.

The man with college education or some other form of specialized training starts at \$1,400 a year, is earning \$5,000 at the age of 49—or an average of \$3,425 a year. He is a leader in his community, has a good car,

*Figures from Government report.

and a comfortable home. You can get ready for opportunities open to Architect, Business Manager, Mechanical Engineer, Professional Accountant, etc., through expert methods of preparation available in your own home, and get the knowledge that will open the way to the higher paid jobs!*

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How about your job? What you think and do is limited to things you know. Every new task or operation—every new job—is a new lesson to be learned, and your grading on that lesson definitely measures your efficiency. You should make it your first order of business to learn everything you possibly can about your present job. Do not be satisfied with just getting by. Become the best informed person on that kind of work in your office or plant.

Next consider the job ahead. Study up on the principles of the new work. Learn all you can about it so when there is an opening and you are offered the chance to step up you will be prepared to make good. All of us are on trial at all times.

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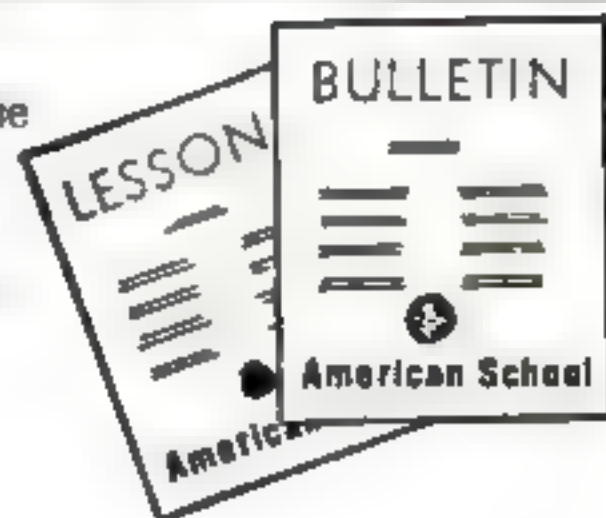


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Our Readers Say



The Missing-Dollar Mystery, or Don't Bet on the Horses

HERE'S some nourishment for the puzzle-hungry guys and gals. Three men stopped at a hotel. The room clerk overcharged them when he collected \$30, or \$10 from each in

AW, THEY WERE SATISFIED AND MY GOAT CAME IN LAST. SO WHAT?



advance, for their suite of rooms. Discovering his error, he sent a bell-hop up to the rooms with the \$5 overcharge. On the way, the bell-hop decided he'd keep \$2 of the \$5 and put it on the nose of his favorite horse. So the three men got back only \$3—\$1 apiece—instead of \$5 owing them. Now, that meant that their total outlay at the hotel was \$27. The bell-hop got \$2, bringing the total to \$29. What became of the other \$1 of the original \$30?—C.S., Baltimore, Md.

Well, It's a Good Thing To Know That We're Back to Normal Again

NOT so long ago, I read about the finding of the frozen body of a mammoth, a huge, long-extinct elephant, in the arctic regions. It was so perfectly preserved by refrigeration that it could have been eaten, had the explorers' appetites been inclined that way. Now, here's what's troubling me. That mammoth was supposed to have been overtaken by the ice age. But according to the well-known "Drayson's theory," which I first read about in the November 1936 issue of your magazine, the ice ages of the past have come and gone slowly—their complete cycle taking 15,878 years. If the ice age came so slowly, the mammoth should

I'M HERE, KID, YOU PUZZLE IT OUT!



have had lots of time to move farther south before it froze into a block of ice. I have a theory to explain the freezing of the mammoth. I believe that the north pole suddenly lost its magnetic attraction for the sun, so that the whole northern hemisphere was suddenly turned away from the sun. The ice cap formed, of course.

The magnetic power of the pole slowly returned, and we're back to normal again. I confess, I don't know which pole will go next.—N. L., Wanham, Alberta, Canada.

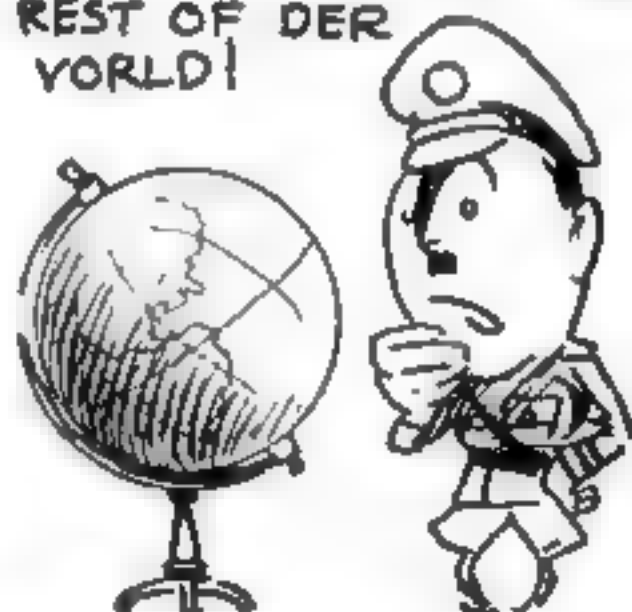
Maybe That's Why Rome Wasn't Built in a Day

MARK up one vote in support of H.D.T., Los Angeles, and his request for articles on elementary surveying. It should be possible to design some simple instruments with which a beginner could perform fundamental operations like measuring angles, leveling, and so on. At a museum I recently saw models of the crude instruments used by the ancient Roman engineers in laying out roads, aqueducts, and huge public buildings. Those old boys apparently didn't have either theodolites or spirit levels, but they got there just the same.—V. O. B., Brooklyn, N. Y.

In That Case We'll Leave Things as They Are

VISITORS to big cities like New York and Chicago are impressed by the height of some of the buildings. What they fail to take into consideration is the really immense area of the floor space of these buildings. I'm wondering if anyone ever figured out approximately how many New Yorks there really are, piled one on top of another. A twelve-story office building covering a city block really represents almost twelve blocks in area. A sixty-story one, even though it gets smaller towards the top, represents perhaps thirty or forty city blocks of usable area. "Manhattan Island" is a totally inadequate phrase to describe the real size of that particular borough of New York City. What's more, if the floor space of all the buildings in the great city were laid out in a sort of giant jig-saw puzzle, Hitler and Mussolini would really see some territory worth coveting.—B. I. A., Plainfield, N. J.

MAYBE IT'S MORE BETTER I TAKE NEW YORK AND FORGET DER REST OF DER WORLD!



And We Don't Feel a Day over Twenty-One

AS A reader of your magazine for over five years, I have yet to see one poorly edited issue put on the newsstands. It seems to me that with the recent innovation of the smaller size, P.S.M. reached the height of perfection. A magazine that can remain on the newsstands since 1872 (Continued on page 14)

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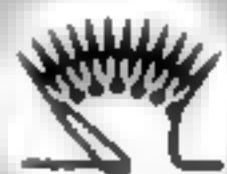
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Our Readers Say (CONTINUED)

surely must have gained the esteem of many. I am just writing this little note to tell you that here is one booster who will never let it down. —M. P., Boston, Mass.

Do Mice Really Play When the Cat's Away?

THAT fellow who tried looking for a needle in a haystack, as described in your July issue, has the true scientific spirit. It's high time

DON'T TAKE AWAY MY ONLY CONTRIBUTION TO CONVERSATION!



we used laboratory test methods on some of those old sayings, to see whether they really are true. I suggest that this investigator turn his attention to other proverbs and saws. For example, he might find a lane that has no turning, and measure it; he might pick out an ill wind (there are plenty of them going

around these days) and make a survey to discover whether it blew *anybody* any good; a specific-gravity test would determine whether blood is really thicker than water. As a beginning, I suggest that when this fellow finds the needle (if he ever does), he might try coaxing a camel through its eye.—D. A. M., Ottawa, Canada.

Hold On to Your Seats Until This Is Settled

WILL some one please straighten me out on this puzzler? As I

HOW DO YOU KNOW IF YOU HAVEN'T WEIGHED YOURSELF IN THOSE TWO PLACES?



understand it, the rotation of the earth does not throw us off because gravity counterbalances centrifugal force. But isn't centrifugal force greatest at the equator and zero at the poles, while gravity is almost constant? If so, why wouldn't I weigh less at the equator?—I. T., Rye, N. Y.

Did a Sense of Time or the Clock Wake Up V. S. P.?

ALTHOUGH I do not believe that the slight tick of a clock would wake up V.S.P., as he stated, I am not in doubt that he did wake up before his alarm went off. I think that people must have a very accurate sense of time, because I always awaken at 7:30 every morning except Sunday. I have to get up at 6 on Sundays, and my mother always comes into

my room to tell me when to get up, but I am always awake about five minutes too early. If the University of Chicago students get some real dope on this matter, I think it would be of much interest to your readers.—H. F. V., Jr., Baltimore, Md.

His Appetite Is All Set for a Home-Movie Dish

POPULAR SCIENCE has been my favorite monthly magazine ever since I bought my first copy, about a year ago. I have only one complaint to make regarding your photography department. It contains much of interest to the still photographer, but not enough on amateur movies. So why not give us home-movie fans more to chew on?—D. B., Meriden, Conn.

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He Never Misses an Issue, nor an Engineering Blunder

COUNT me in as one of your most enthusiastic fans. I never miss an issue. As to the subject matter, I am rather omnivorous. But even if I do not care for some of your articles, I can leave them for the guy that does. P.S.M. is a big magazine now. Now for some brickbats. I was particularly interested in the articles about buried treasure on Oak Island, and—take it easy now—I have no hair-brained ideas to air on the subject, merely a suggestion. On page 107 of the June issue, I note a grave engineering blunder, namely, the location of the pump to keep down the water level. It is represented as about ninety feet above the surface of the water in the pit. I live in the land-pebble-phosphate district of Florida, and we use centrifugal pumps on a large scale in mining operations. We find that, although it is theoretically possible to lift water about thirty-two feet under vacuum at sea level, practically, a centrifugal pump will not operate successfully with a suction head of more than about sixteen feet. If Mr. Hedden is "banking" on pumping the "money pit" dry under the conditions illustrated, I think it would be a good idea to "invest" in a diving suit for the driller. However, he might go to town if he put the (Continued on page 16)

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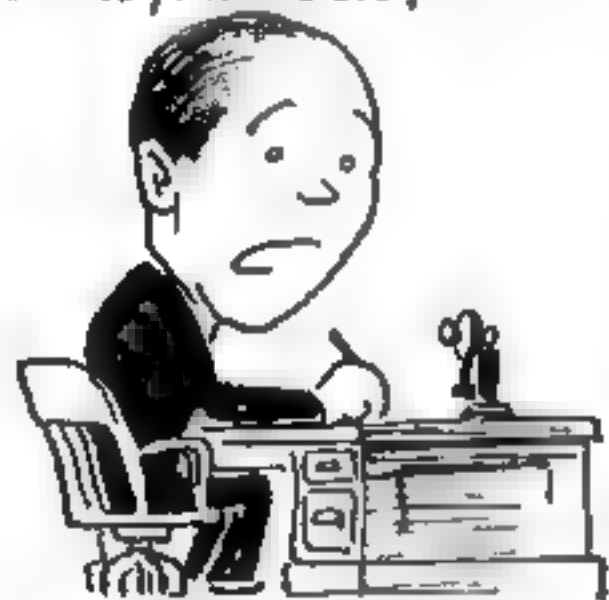
pump in the well. More power to him.—
E. J. E., Bartow, Fla.

We'll Have To Use Sky Hooks To Pull Them Much Faster

IT SEEMS to me that it's time we started to look for something to replace propellers on planes, if we expect to make planes much faster. Several planes, I understand, already hit over 450 miles an hour in level flight. That's more than half as fast as sound. I've been told that an airfoil such as a propeller blade loses its efficiency when it reaches the speed of sound. Now, on a nine-foot propeller revolving at about 1,100 revolutions a minute, which is about average for one of efficient design, the tips of the blades travel nearly 600 miles an hour. Add something to this for the forward speed of the plane. You find the tips are already traveling almost as fast as sound, which is about 750 miles an hour—or the point where they cease to act as propellers. From here on, the faster they turn, the shorter the effective length of the blades becomes, until they lose so much efficiency that the plane won't accelerate any more. Certainly propellers will never make planes go anywhere near the speed of sound.—E. F., Atlanta, Ga.

Pages 100 and 101 Should Answer This One

FIRST COST, UPKEEP,
GALES, CYCLONES, NO
WIND, LIGHTNING, BREAK
DOWNS, AW HECK!



A RECENT Washington dispatch stated that Government scientists were perfecting a method of taking heat and energy (steam) from the sun's rays. Taking this lead, I herewith divulge my idea of heating our homes from nature's stored energy. You undoubtedly have heard of windchargers, generators of electricity, sold mostly to ruralites. As a general rule, these machines are small affairs, charging six-volt batteries with electricity. Now then, couldn't these modern windmills be built on a much larger scale, erected on high towers, then put to work producing sufficient electricity to enable us to heat our homes electrically? Turning the blasts of the wintry wind into warmth and comfort would be an achievement.—M. J. C., Chicago, Ill.

Geometrically Speaking, He's Doing Well

HERE are the answers I get to the problem in the July issue about the problem of the truncated conical tank. The volume of the lower half—either half for that matter—is

174.35 cubic feet. The top diameter of the lower half is 7.14004 feet. The height of the lower half equals 3.87 feet. How'm I doin'?—
T. G. R., Pittsburgh, Pa.

Can Somebody Lick This Fellow's Problem?

HAVE been reading your magazine since May 1933, and notice from time to time that readers solve one another's problems. I have one. My hobby is duplicator work. That is, the type of work done with a stencil duplicator. What has me puzzled is what chemical or combination of chemicals can I use as an error-correction fluid. I have tried acetone and collodion, but can't seem to get the right results. If there is some other reader who has this problem licked, I'll be his friend for life if he will let me in on his secret.—
R. L. P., Bellevue, Pa.

MIGHT TRY NOT MAKING
ERRORS



It's the Next Best Thing to Going to the Fairs

EVEN though I can't get to the two big world's fairs, I feel as though I've done the next best thing after reading your splendid articles about them. Keep it up!—I. N., Tulsa, Okla.

A Reader Takes Time Out To Give the Watch Its Due

WHAT is the most taken-for-granted invention? Is it the faucet, the comb, the jackknife, the telephone, what? I nominate the watch. Year in and year out, we carry these amazing mechanisms and rarely give a thought to their intricate insides. Yet, I have seen figures that show that one of the tiny wheels will spin around 4,000,000 times in a year and the balance staff alone travels 14,000 miles in twelve months. Some of the screws in an average watch are so tiny it would take 20,000 to fill a thimble and 500,000 to weigh a pound. And one pound of hairspring steel makes eight miles of hairsprings, worth \$75,000. All in all, my opinion is that the intricate and accurate present-day watch leads the list of inventions we take for granted.—L. C., Scarsdale, N. Y.

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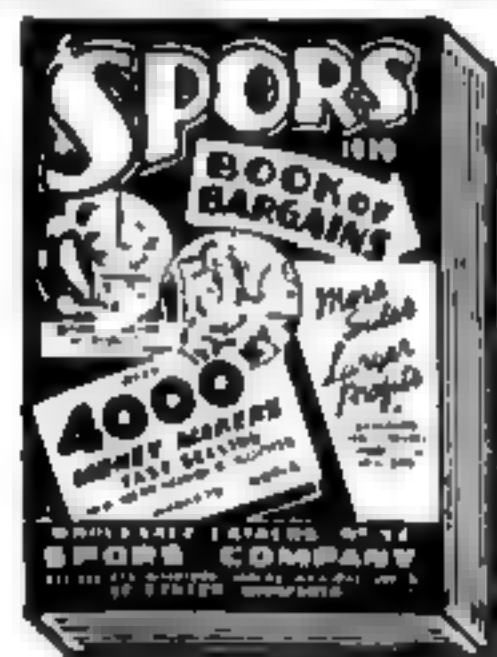
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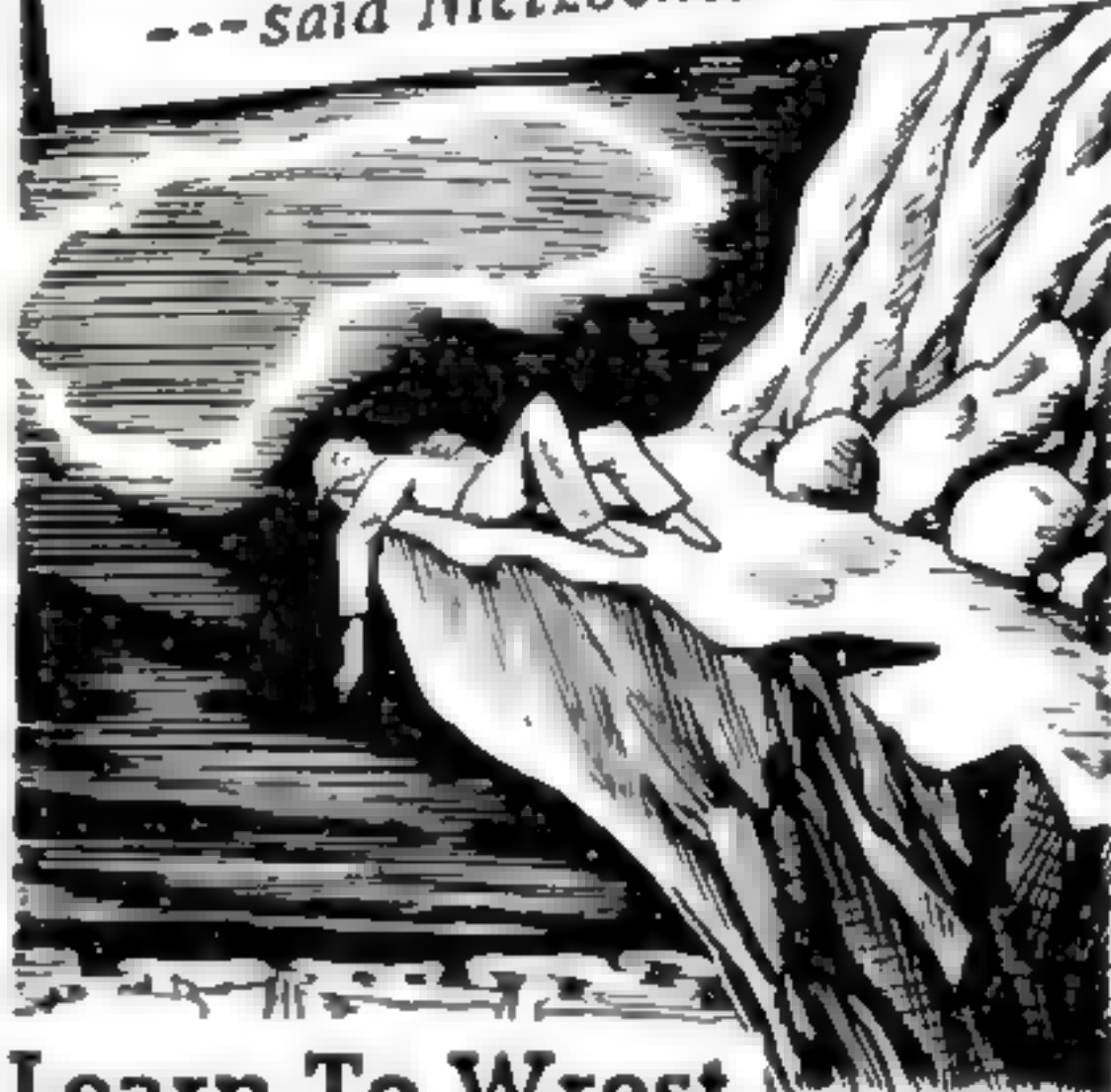
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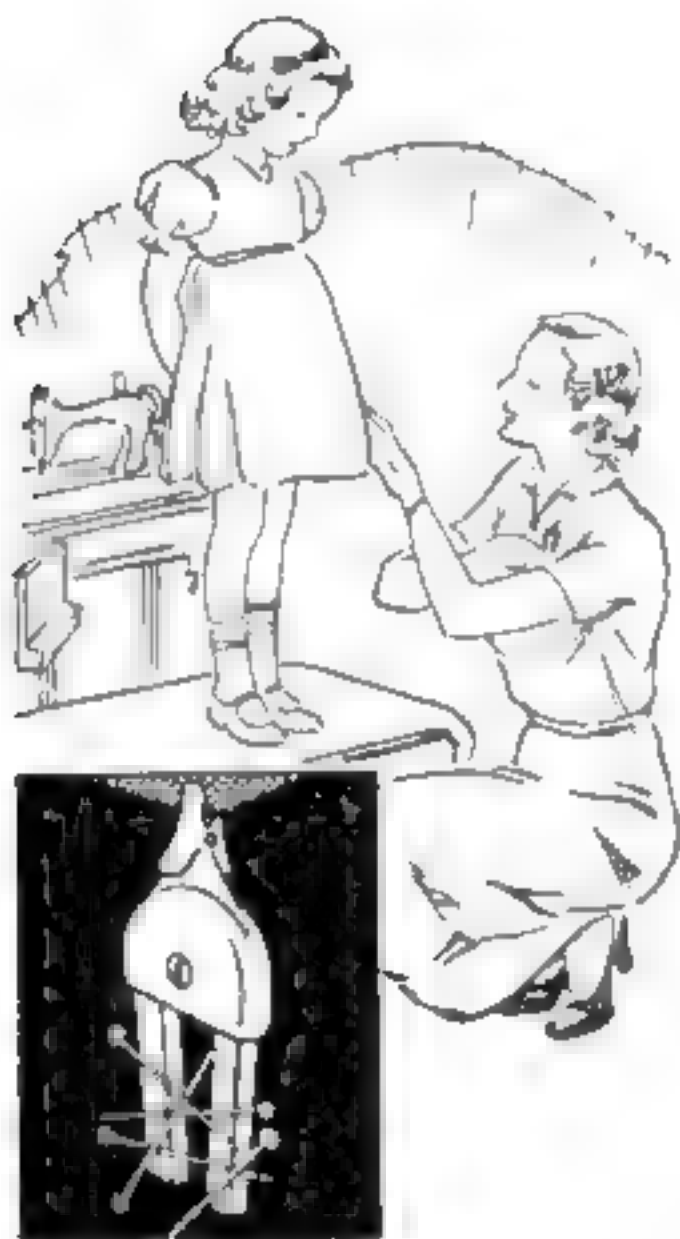
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With the Inventors



GROPING FOR PINS while fitting a dress is made unnecessary by a magnetic holder invented by Arthur H. Madore, of Los Angeles, Calif. Pins cling to a small horseshoe magnet, which is provided with a spring clip so that the unit can be hung any place on the clothing of the fitter conveniently within reach . . . THE TOTAL NUMBER OF PATENTS issued annually in the United States has been de-

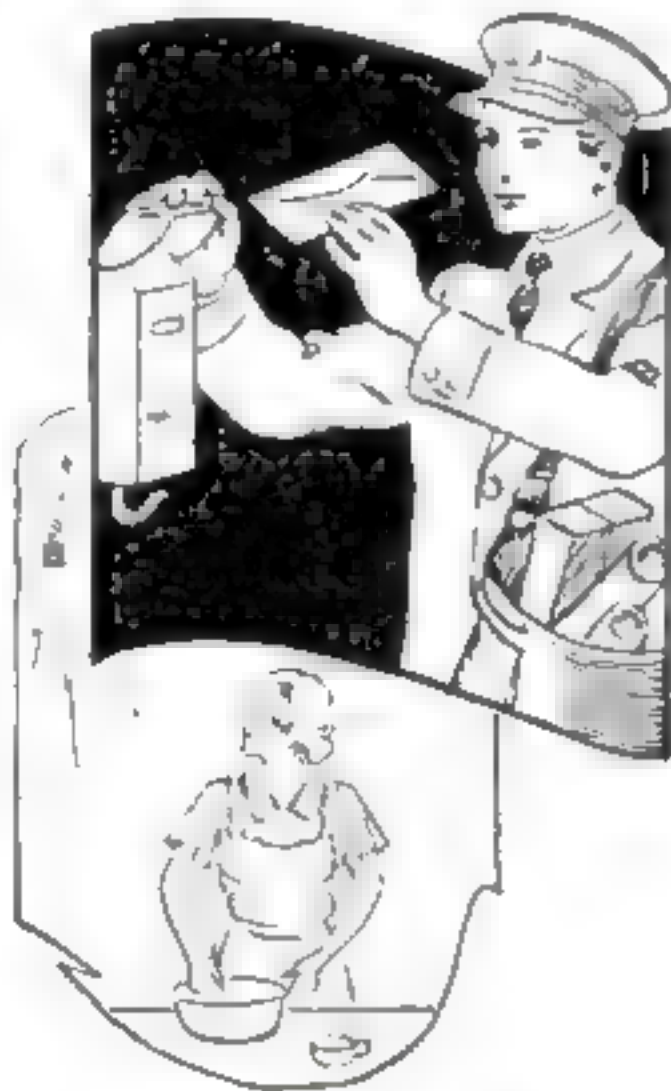
creasing gradually from the peak of 53,500 issued in 1932 . . . TUFTS OF BRISTLES are provided on both ends of the handle of a double-action toothbrush devised by Stephen F. Fitzgerald, of Pittsburgh, Pa. One end of the



brush is used in the ordinary manner, while the other, set at an angle by a twist in the composition handle, supports a brush specially designed to clean the back of the teeth and reach spots that are often untouched by the conventional brush . . . CURIOUS PATENT

TITLE: 2,157,445, Method for Determining "Wow" . . . READILY INSTALLED in home mail boxes, an electric device invented by Joseph Komorowski, of Millvale, Pa., notifies the occupants of a house whenever the postman deposits mail in the box. When the letter carrier lifts the mail-box top to insert letters, an electric

switch is closed, ringing a bell inside the



(Continued on page 22)

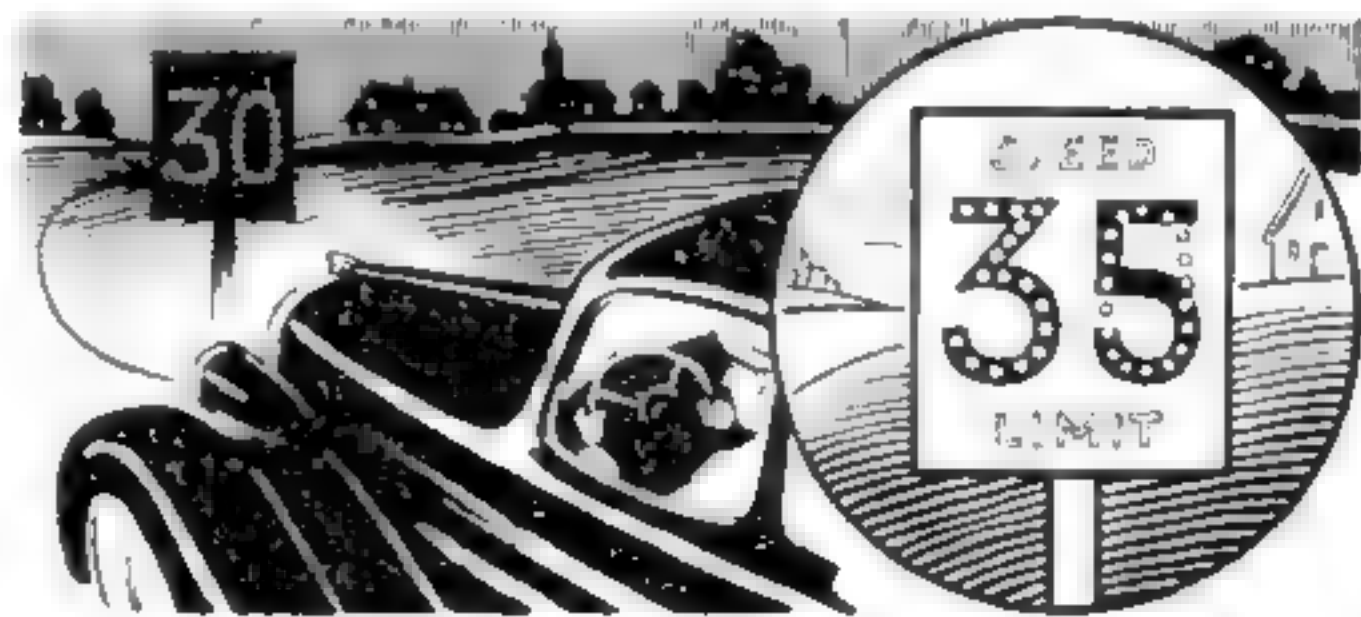
house. A transformer enables regular house current to be used to operate the unit . . .

THE CLAIMS APPENDED to a patent legally define the invention, and are the inventor's

statement of what he regards as new and original with him. What he describes in the patent specifications, but does not claim, can be freely used by anyone . . . TO MAKE IT EASY for music students to practice on their instruments by playing selections accompanied by phonograph records, King Ross, of Jackson Heights, N. Y.,



has invented a method of recording in which the melody part of a piece of music is subdued in volume. When the record is played, the student takes the melody part, accompaniment being provided by other orchestral instruments heard through the phonograph loudspeaker . . . THE OLDEST PATENT IN EXISTENCE, issued on January 31, 1791 to Francis Bailey, was signed by both George Washington and Thomas Jefferson, the former as President of the United States and the latter as Secretary of State. Three earlier patents were destroyed in the great Patent Office fire of 1836 . . . CHANGEABLE highway signs that indicate to motorists one maximum speed limit during the daytime and a lower speed at night, are the contribution of Harry E. Stedman, of Des Moines, Iowa, to traffic safety. During the daylight hours, car drivers see numerals, such as 35, lettered on the roadside speed-limit sign in black. At night, however,



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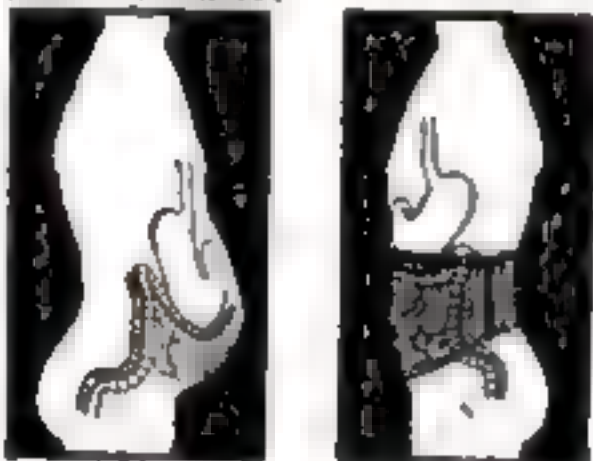
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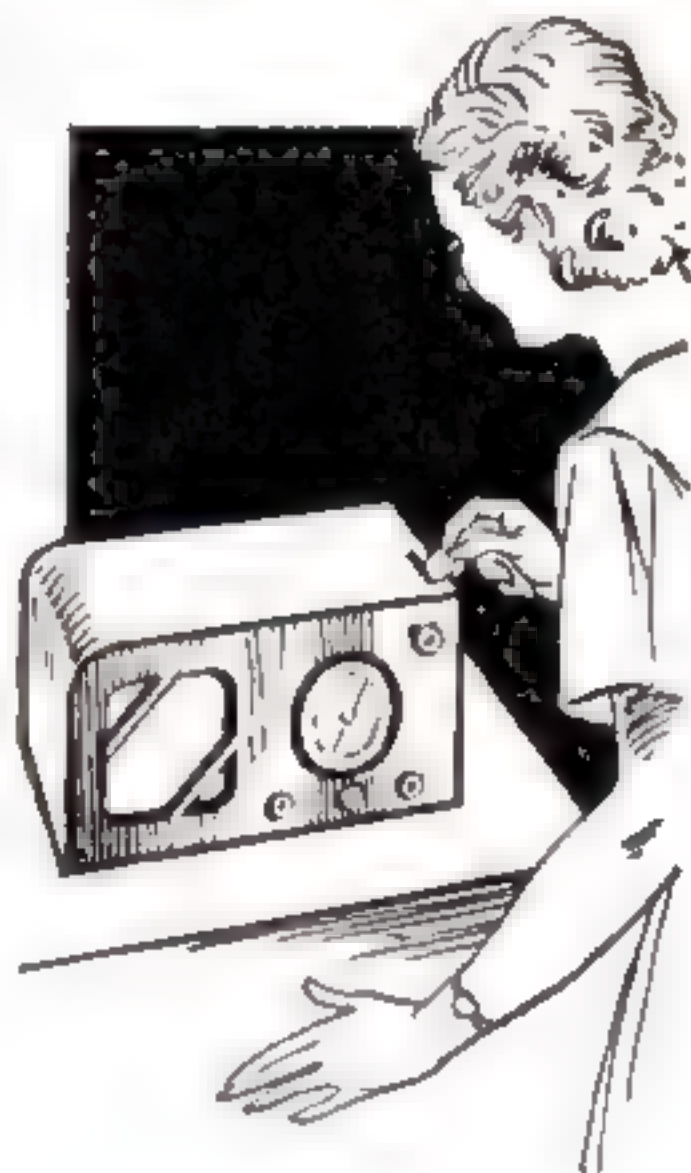


With the Inventors

(Continued from page 20)

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STANDARD folding card table can be converted into a child's playhouse with an invention credited to Harold R. Goodale, of Bristol, Conn. Windows, doors, and other exterior building trim are represented on a fabric canopy which is draped over the table to form the walls and roof of a tiny playhouse. A box set on the

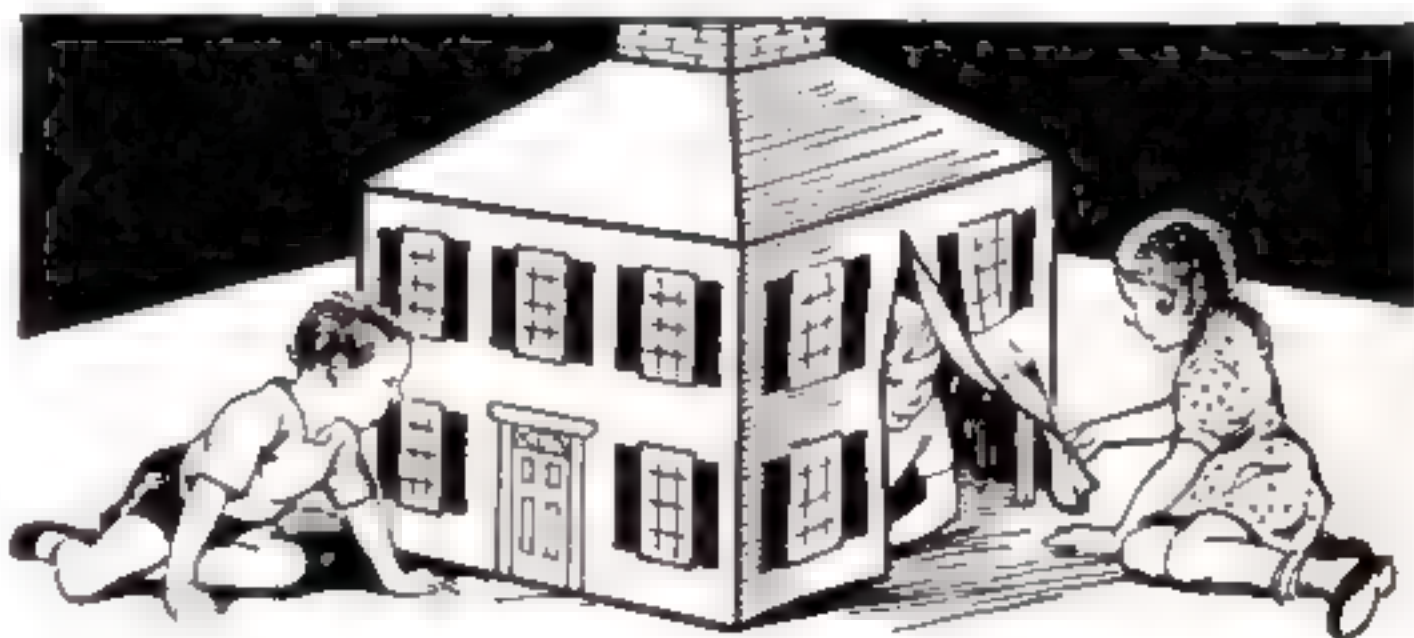


table top supports the chimney, and a slit in one side serves as an entrance and exit... **A PATENT GRANTS THE HOLDER** the exclusive right to make, sell, and use his invention for a period of seventeen years. Theoretically, if anyone, without the express authority of the patentee, makes the invention, even though he has no intention of selling it, or making any kind of profit from it, he is infringing the patent and can be sued by the patent holder.

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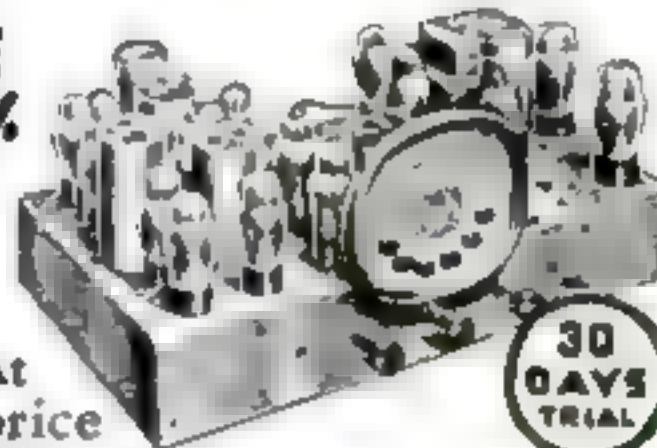
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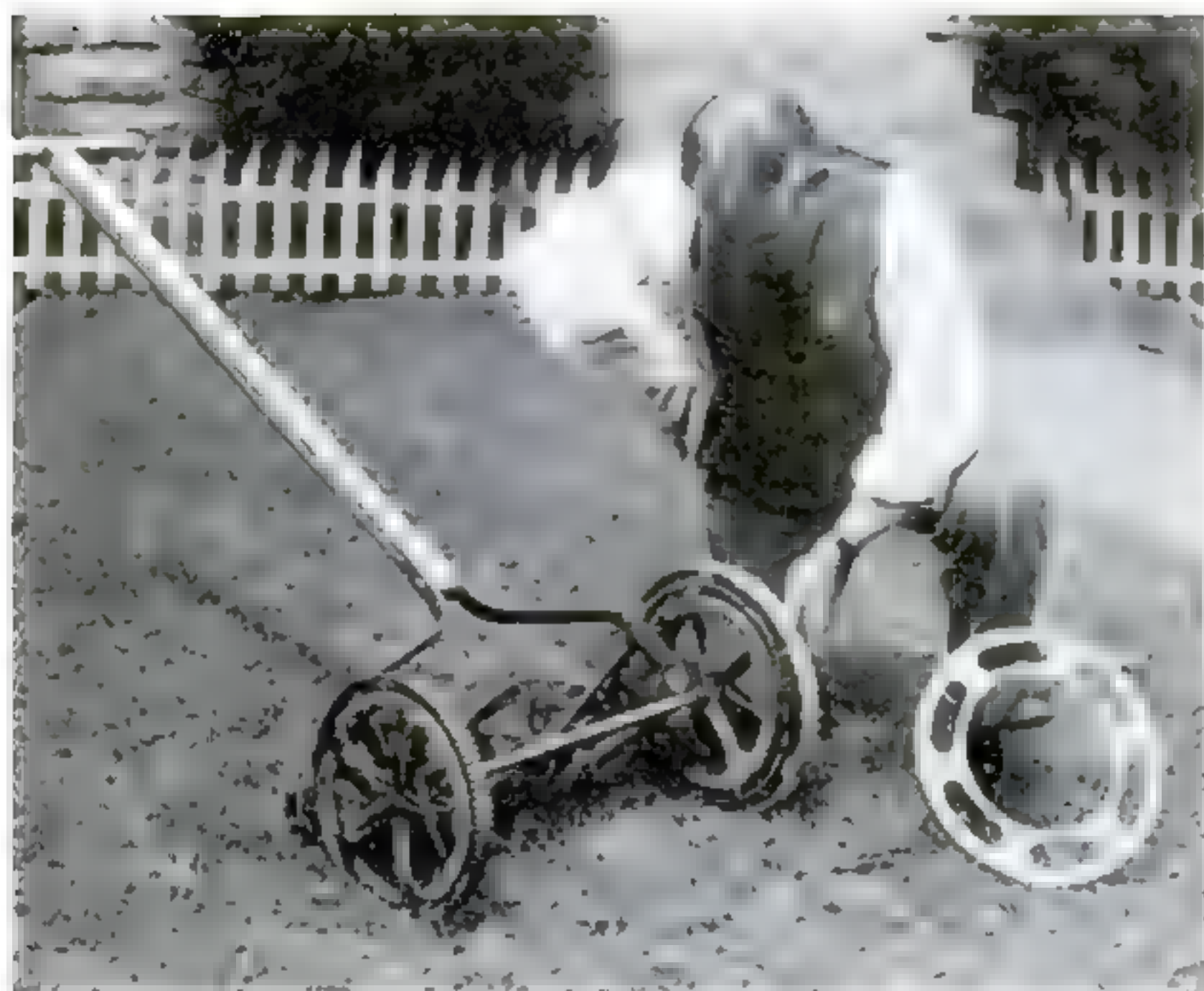
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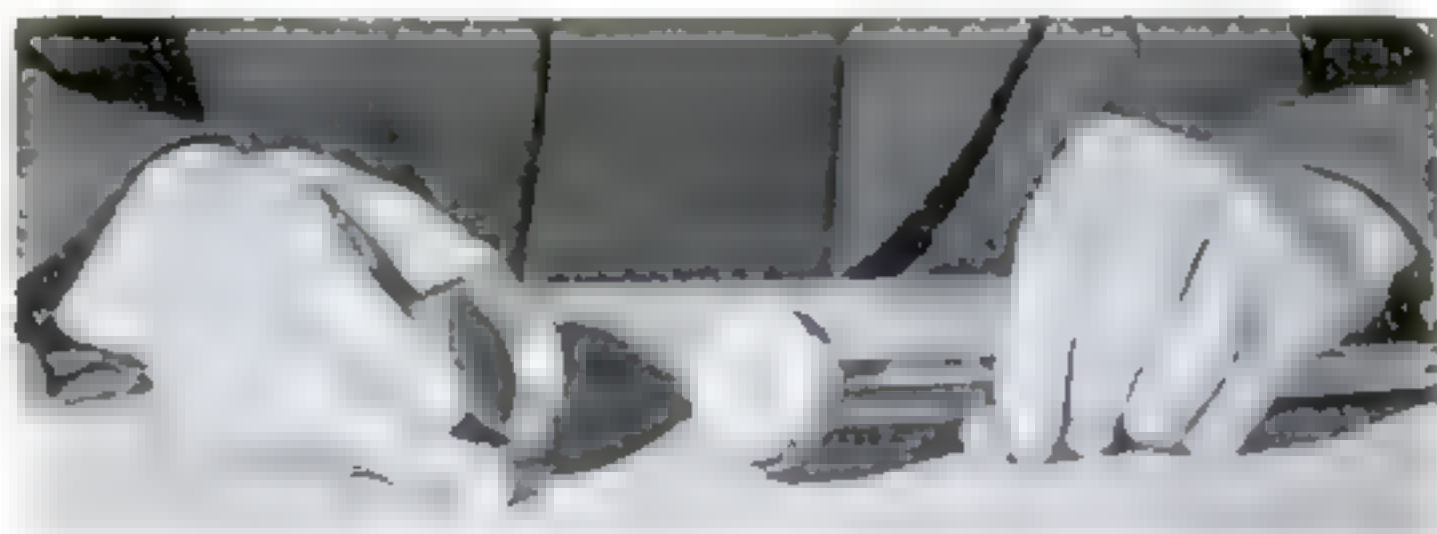
SINCE the food that supplies energy for the growth of blue grass is manufactured in the grass leaves themselves, close cutting of blue-grass lawns will often starve them and encourage the growth of crab grass, dandelions, and other weeds. To prevent this, auxiliary rims for lawn-mower wheels now being marketed are designed to raise the cutting knives at least two inches above the soil, thus insuring against close cropping of the grass. The wheel rims fasten directly over the regular mower wheels, while special brackets serve to lower the roller.

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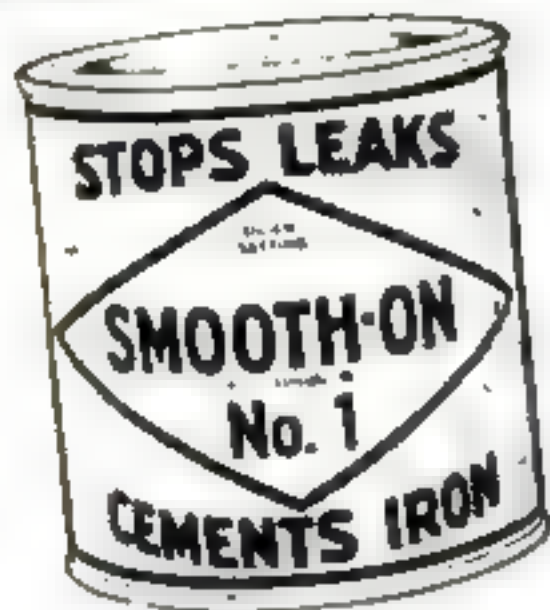
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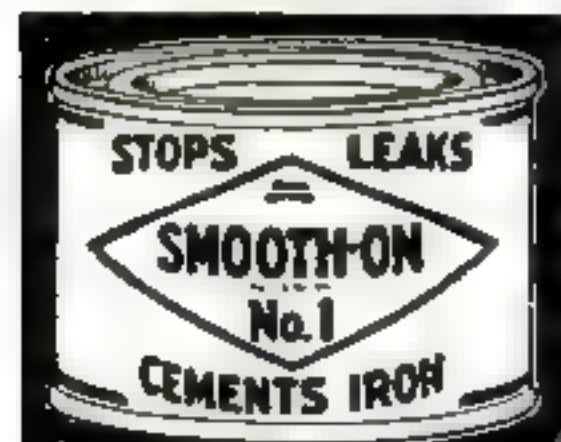
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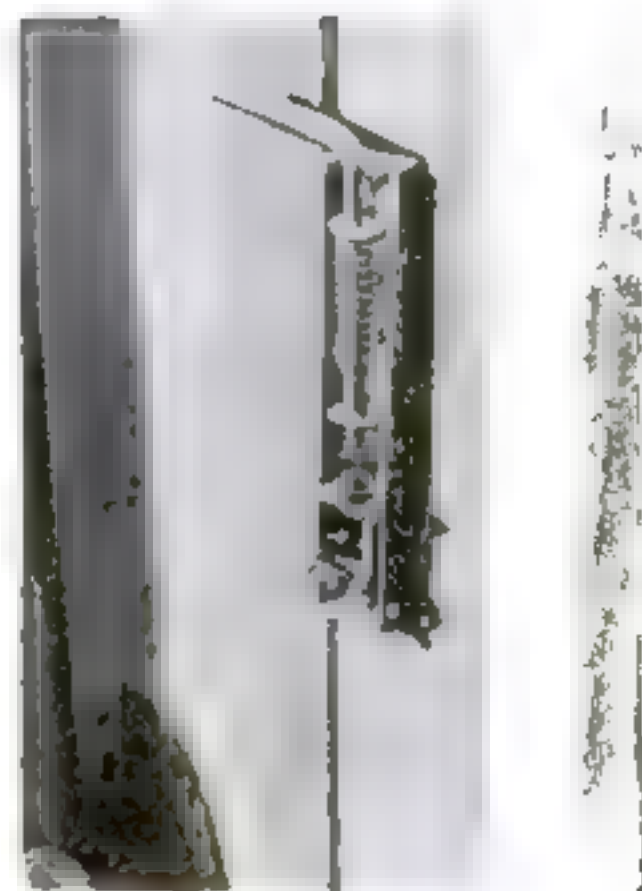
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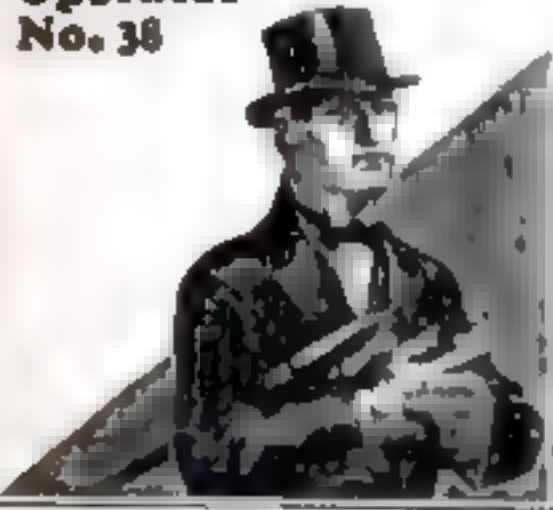
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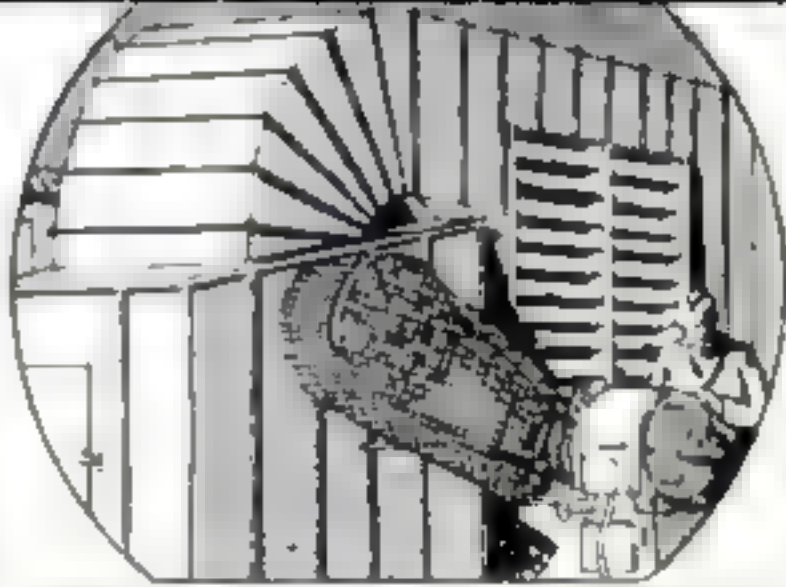
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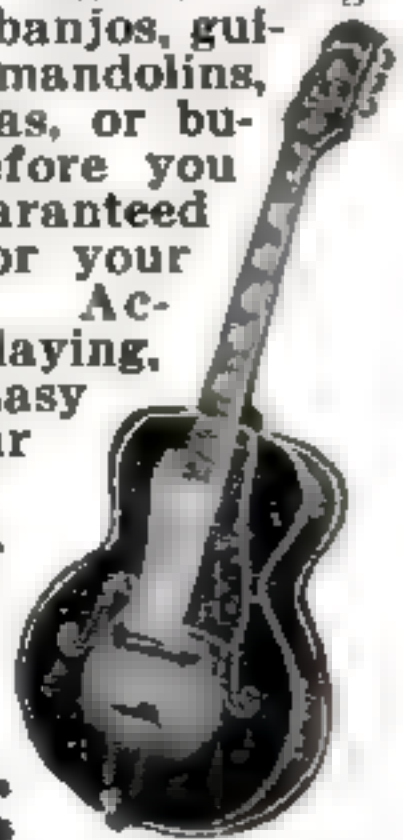


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OL' JUDGE ROBBINS

BACK HOME

A REUNION WITH
OLD FRIENDS

IT SEEMS LIKE OLD TIMES
TO HAVE YOU BACK WITH
US, ROB!

WELL, IT'S A GREAT THRILL
TO SMOKE A PIPEFUL OF
PRINCE ALBERT WITH
YOU FELLOWS AGAIN

WHAT MADE THE
BIGGEST IMPRESSION
ON YOU, ROB, DURING
YOUR TRIP?

BET THAT NIAGARA
FALLS TOOK YOUR EYE,
EH, ROB?

YOU SENT A LOT OF CARDS
FROM YELLOWSTONE, JUDGE.
GUESS YOU LIKED IT
THERE RIGHT WELL

WELL, THERE WERE ANY
NUMBER OF INTERESTING
SIGHTS, BUT THE THING THAT
IMPRESSED ME MOST WAS
THE NUMBER OF MEN I SAW
REALLY ENJOYING
THEIR PIPES

YOU MEAN THE
PRINCE ALBERT SMOKERS,
EH, JUDGE?

YES, I DO, AND IT WAS
EXCITING TO SEE SO
MANY SMOKERS
GETTING REAL
PIPE PLEASURE

WELL, WHEN
A TOBACCO IS
AS MILD AND
RICH-TASTING AS
P.A. THE NEWS
GETS AROUND
FAST

AND NO MATTER WHERE I BOUGHT
PRINCE ALBERT, I FOUND IT AL-
WAYS THE SAME — FRESH, EASY-
DRAWING, AND
MELLOW-
SMOKING!

3 STEPS TO TRUE PIPE-JOY

YOU CAN'T GET MILD,
RICH, TASTY SMOKING
OUT OF YOUR PIPE IF YOU
DON'T PUT RIGHT
TOBACCO IN!
EVER TRIED
PRINCE ALBERT?



Smoke 20 fragrant pipefuls
of Prince Albert. If you don't
find it the mellowest, tasti-
est pipe tobacco you ever
smoked, return the pocket tin
with the rest of the tobacco
in it to us at any time within
a month from this date, and
we will refund full purchase
price, plus postage. (Signed)
R. J. Reynolds Tobacco Co.,
Winston-Salem, N. C.

"MAKIN'S" SMOKERS! YOU'LL BE AMAZED AT P.A.'S EASY ROLLING TOO!

PRINCE ALBERT THE NATIONAL JOY SMOKE

PRINCE ALBERT

"NO-BITE" TREATED

"CRIMP CUT"

CHOICE TOBACCOS

50

pipefuls of
fragrant to-
bacco in every
handy tin of
Prince Albert

4 Apr 1939
R. J. Reynolds Tobacco Co.

CHEMICAL MAGIC CREATES New Riches from Coal

WENTY-FOUR hours a day, an endless stream of coal pours into a chemical factory at Belle, W. Va. Transformed by the wizardry of modern chemists, it emerges from the other end of the plant as more than 100 different substances—ammonia for refrigeration, alcohol for antifreeze, and ingredients for fertilizer, synthetic plastics, and the super-rayon of tomorrow.

Two thousand Du Pont workers at Belle are doing amazing things with coal—things unknown even to scientists only a few years ago. To these overalled magicians, coal means more than something merely to burn. It represents carbon, the key element in countless valuable chemical compounds. So, as the black nuggets pass through a veritable "chemical assembly

By **PAUL A. CLARKSON**



Science opens vast
new frontiers for
one of the nation's
largest industries

THE "ASSEMBLY LINE"

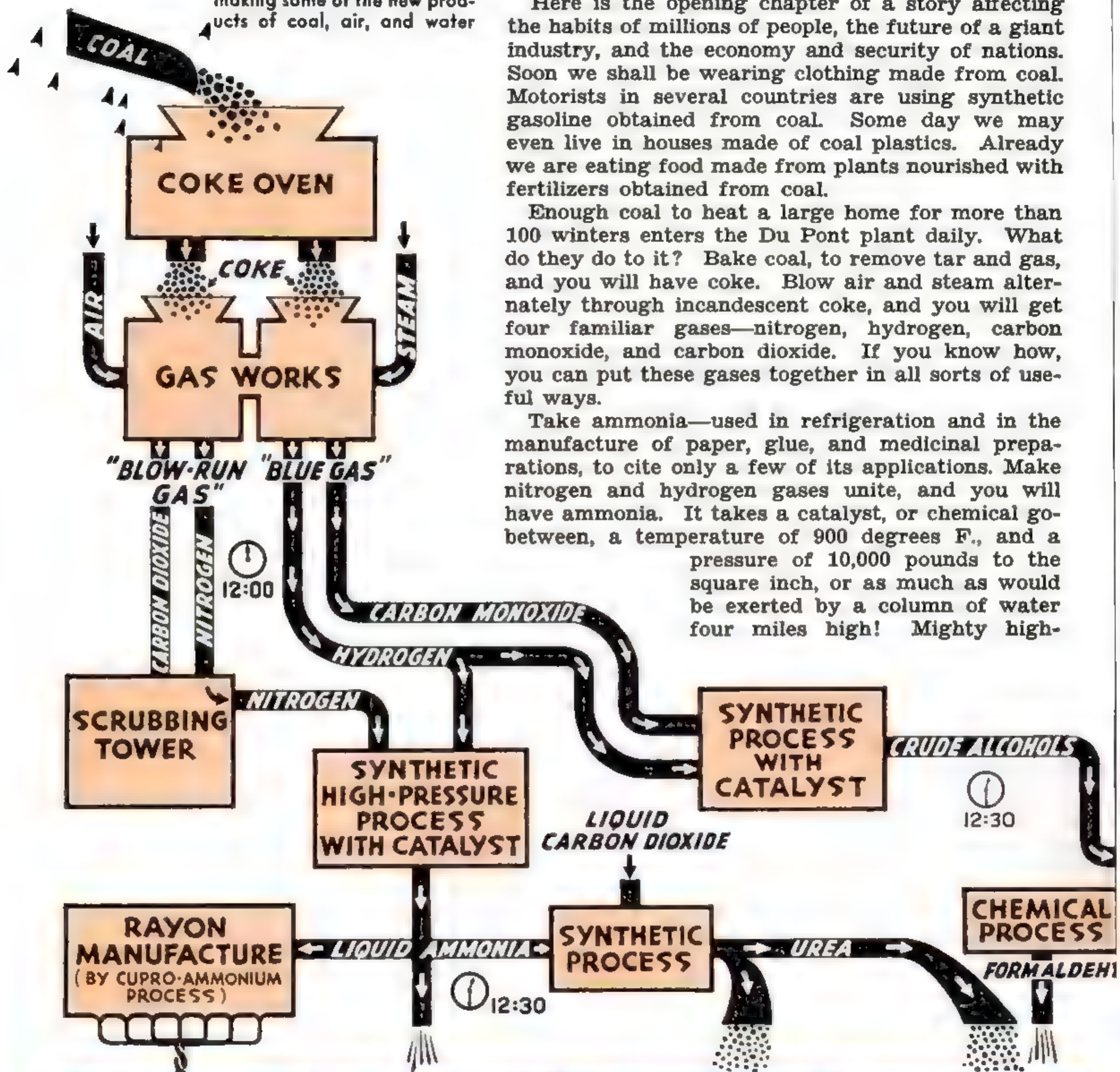
The simplified diagram below shows the principal steps in making some of the new products of coal, air, and water

line," the new technique of high-pressure chemistry combines them with air and water to produce scores of made-to-order synthetic products.

Here is the opening chapter of a story affecting the habits of millions of people, the future of a giant industry, and the economy and security of nations. Soon we shall be wearing clothing made from coal. Motorists in several countries are using synthetic gasoline obtained from coal. Some day we may even live in houses made of coal plastics. Already we are eating food made from plants nourished with fertilizers obtained from coal.

Enough coal to heat a large home for more than 100 winters enters the Du Pont plant daily. What do they do to it? Bake coal, to remove tar and gas, and you will have coke. Blow air and steam alternately through incandescent coke, and you will get four familiar gases—nitrogen, hydrogen, carbon monoxide, and carbon dioxide. If you know how, you can put these gases together in all sorts of useful ways.

Take ammonia—used in refrigeration and in the manufacture of paper, glue, and medicinal preparations, to cite only a few of its applications. Make nitrogen and hydrogen gases unite, and you will have ammonia. It takes a catalyst, or chemical go-between, a temperature of 900 degrees F., and a pressure of 10,000 pounds to the square inch, or as much as would be exerted by a column of water four miles high! Mighty high-



ARTIFICIAL SILK



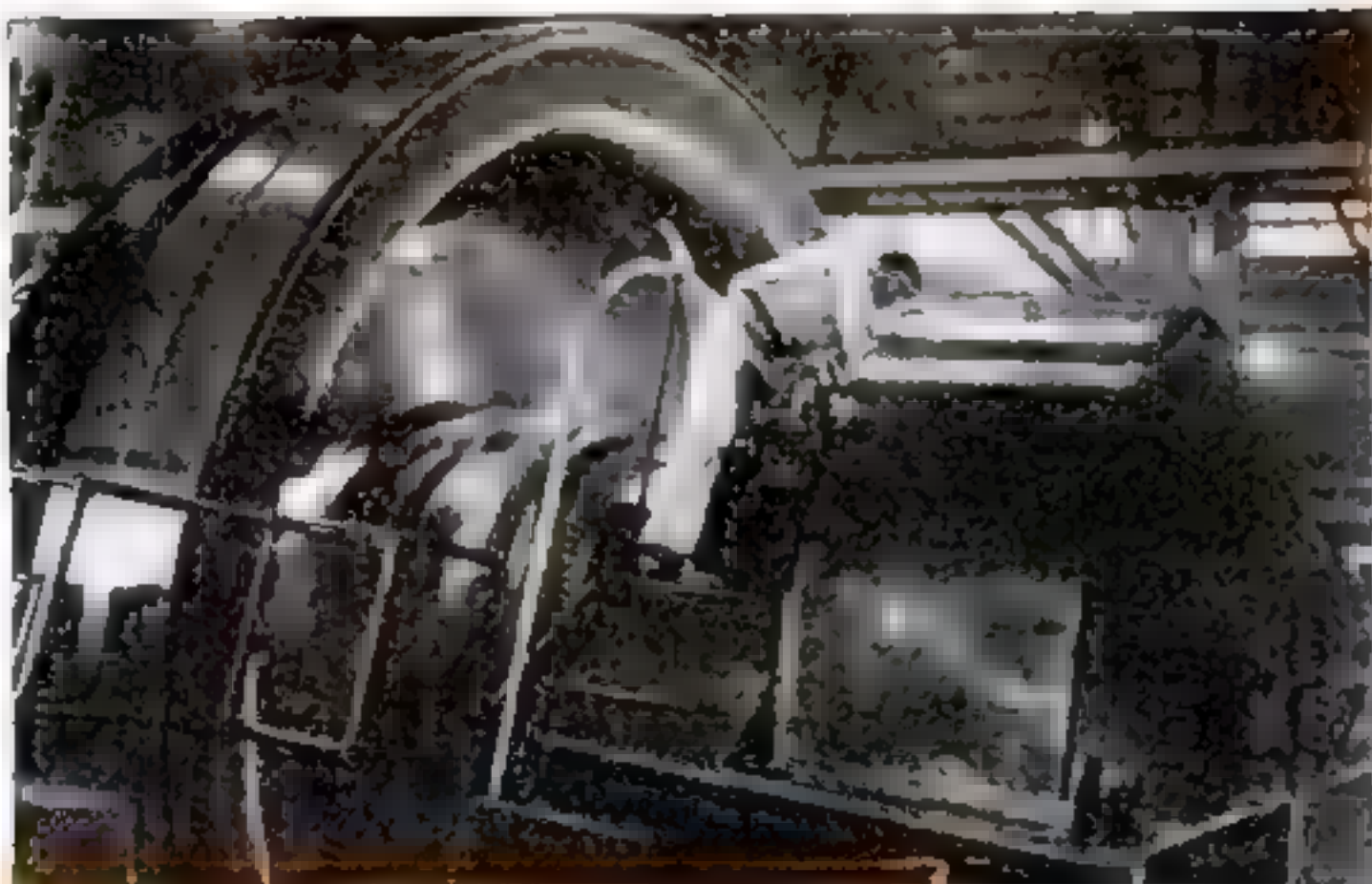
REFRIGERANT



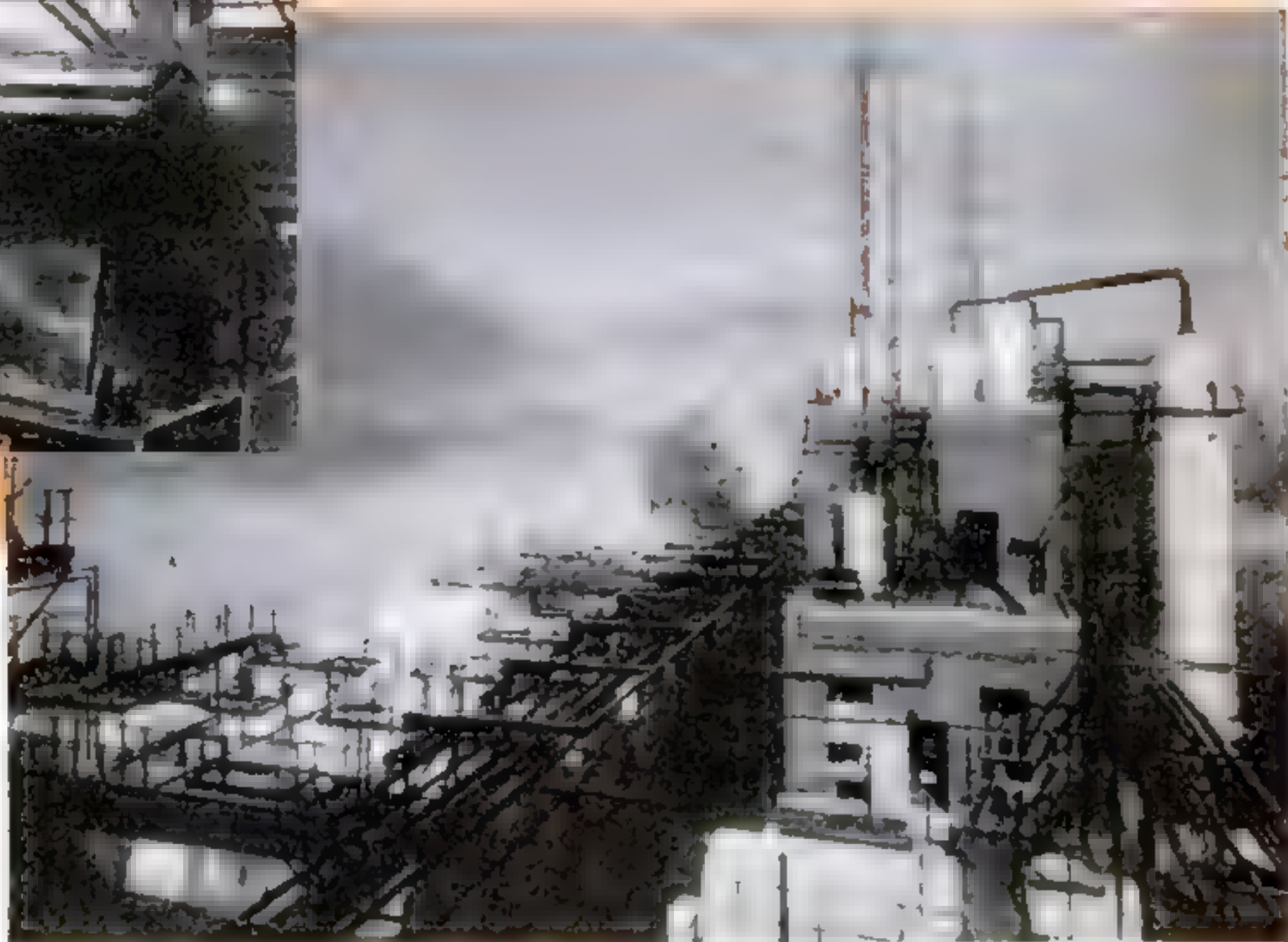
FERTILIZER



PLASTICS



Du Pont's chemical factory at Belle, W. Va., and, left, one of the compressors that help in forcing gases to combine to form synthetic ammonia



pressure compressors—the workers at Belle call them “hypers”—squeeze the purified gases into huge metal tubes under this terrific pressure. Liquid ammonia drains from the tubes.

A white, crystalline substance called urea, pouring like snow from a conveyor belt at a near-by point in the Belle “assembly line,” finds wide application in fertilizers. With formaldehyde, also made from coal at the same plant, urea forms synthetic plastics for automobile hardware, cutlery handles, nonshattering tumblers and kitchenware, and molded parts for radios and scales. Urea also is being employed in adhesives, finishes, stains, pharmaceutical preparations, and creaseproof and wrinkle-proof fabrics. The compound was the first

product of the animal kingdom to be made synthetically from minerals, an achievement long believed impossible. High temperature and pressure create it from the union of liquid ammonia and liquid carbon dioxide.

Synthetic plastics of a beautiful, crystal-clear type are made from a heavy liquid that resembles glycerin, called formamide, produced from ammonia. Even more transparent than window glass, they can be shaped, sawed, drilled, and sanded like wood.

Dissolved in solvents or emulsified in water, they serve as adhesives and var-
(Continued on page 210)



AUTO ANTIFREEZE



**INGREDIENTS OF
AUTO BRAKE FLUIDS**



**LIQUIDS FOR
ORE FLOTATION**



**MOLD PREVENTIVE
FOR BREAD**

Stanley Sawyer Woolley, Jr., answering a call at his office while keeping a couple of his animal models in hand

Woolley takes each animal to the studio and helps the artist or photographer to get an effective pose



He Rents Animals AS PHOTOGRAPHERS' MODELS

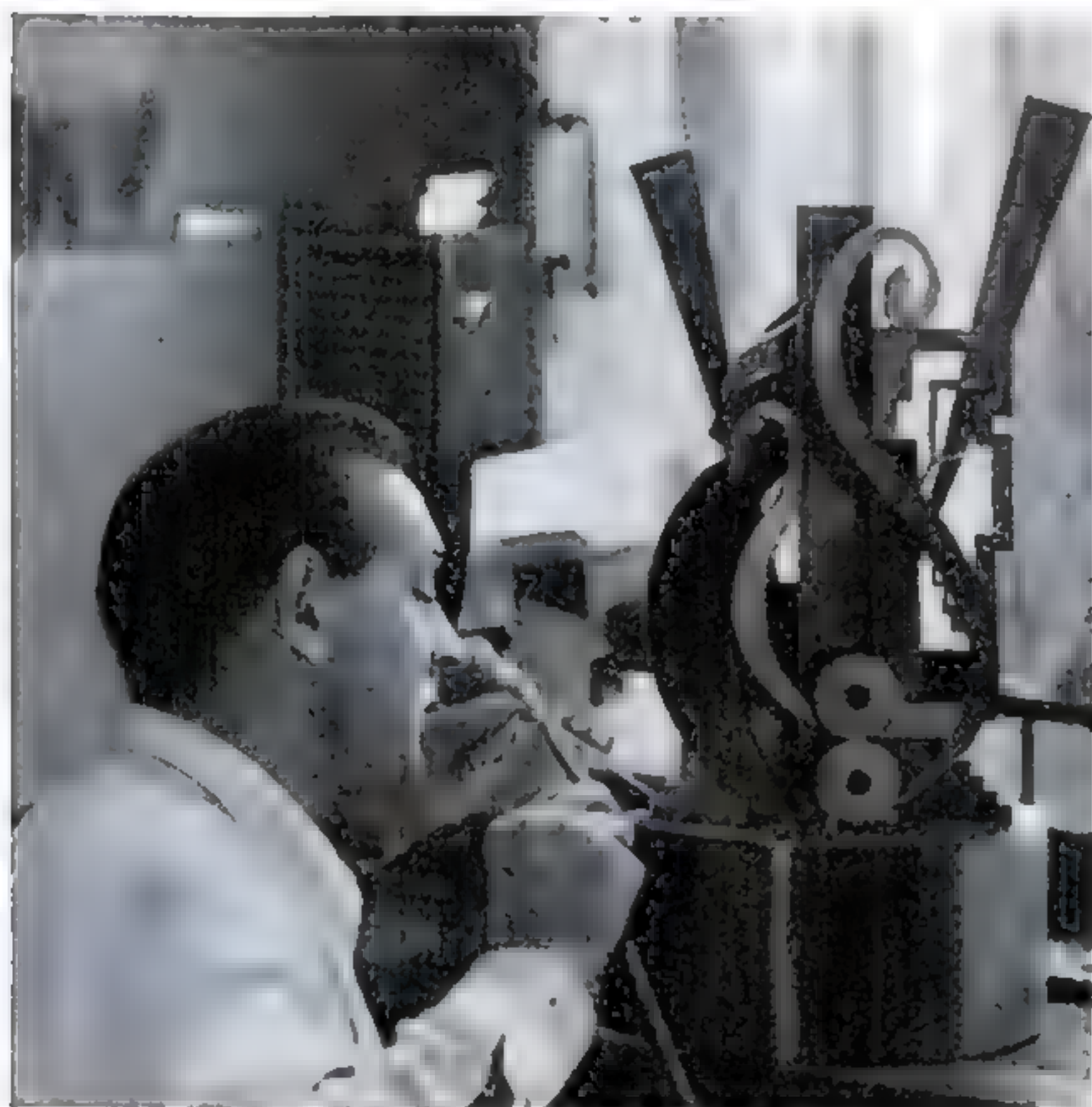
was making pocket money posing as a professional photographer's model. He noticed that photographers often had difficulty locating a special kind of animal for a picture.

WHY NOT start an agency through which photographers and commercial artists could hire animals to serve as models? Many persons scoffed at the idea as scatterbrained, but its originator, eighteen-year-old Stanley Sawyer Woolley, Jr., was convinced it would work and has built up a thriving business in New York City renting out Norwegian elkhounds, two-toed sloths, harpy eagles, boxing kangaroos, and a host of other rare and common animals for use as commercial models. Young Woolley first conceived the idea when he himself

Now, however, their task is simple. They merely phone Woolley's Fifth Avenue office, make their request for a tame rabbit or a lion cub, and within a short time, Woolley appears with the four-legged model. He does not own the animals he supplies, but merely acts as an agent. In his office file cabinet he has a list of persons willing to rent the services of the animals they own, and a list of the species available. His list has been growing steadily, and he is now able to answer hurry calls for eighty-nine breeds of dogs, six kinds of snakes, fifty species of birds, and eighty-two other varieties of animals when needed by his clients.

Useless Metal Brings Artist Success

TIN SNIPS, solder, and a small blowtorch brought unexpected honor to Philip Kran Paval, California artist, who used them to fashion the curious figures shown below and at the right. Paval, known in California art circles as a painter, is a silversmith by trade, and got started in his odd hobby after he had bid in a box of unidentified metal at an auction. Instead of the silver he hoped to find, however, the box contained sheet brass, for which he had no use. So he set to work with his blowtorch and tin snips and created the figure at the right, which he entered in an exhibition of painting and sculpture held in Los Angeles. Inspired by the fact that it won third prize, Paval turned out other pieces, including one now on display at the New York World's Fair.



Philip Kran Paval at work on one of his sheet-metal creations. The figure above won him an award in an exhibition

Poison-Vapor Detector Warns Factory Workers

DESIGNED to warn factory workers of the presence of dangerous amounts of mercury vapor in the atmosphere, a detecting device now available consists of a truncated metal cone with a 25-watt light bulb in the base and a curved paper holder at the top. Air heated by the bulb is carried up through the cone, which acts as a chimney, to a strip of chemically sensitized paper in the holder at the top. Mercury vapor in the air colors the sensitized paper, which is compared with a color chart to determine the percentage of vapor present in the air. An observation window in the unit makes the paper readily visible.



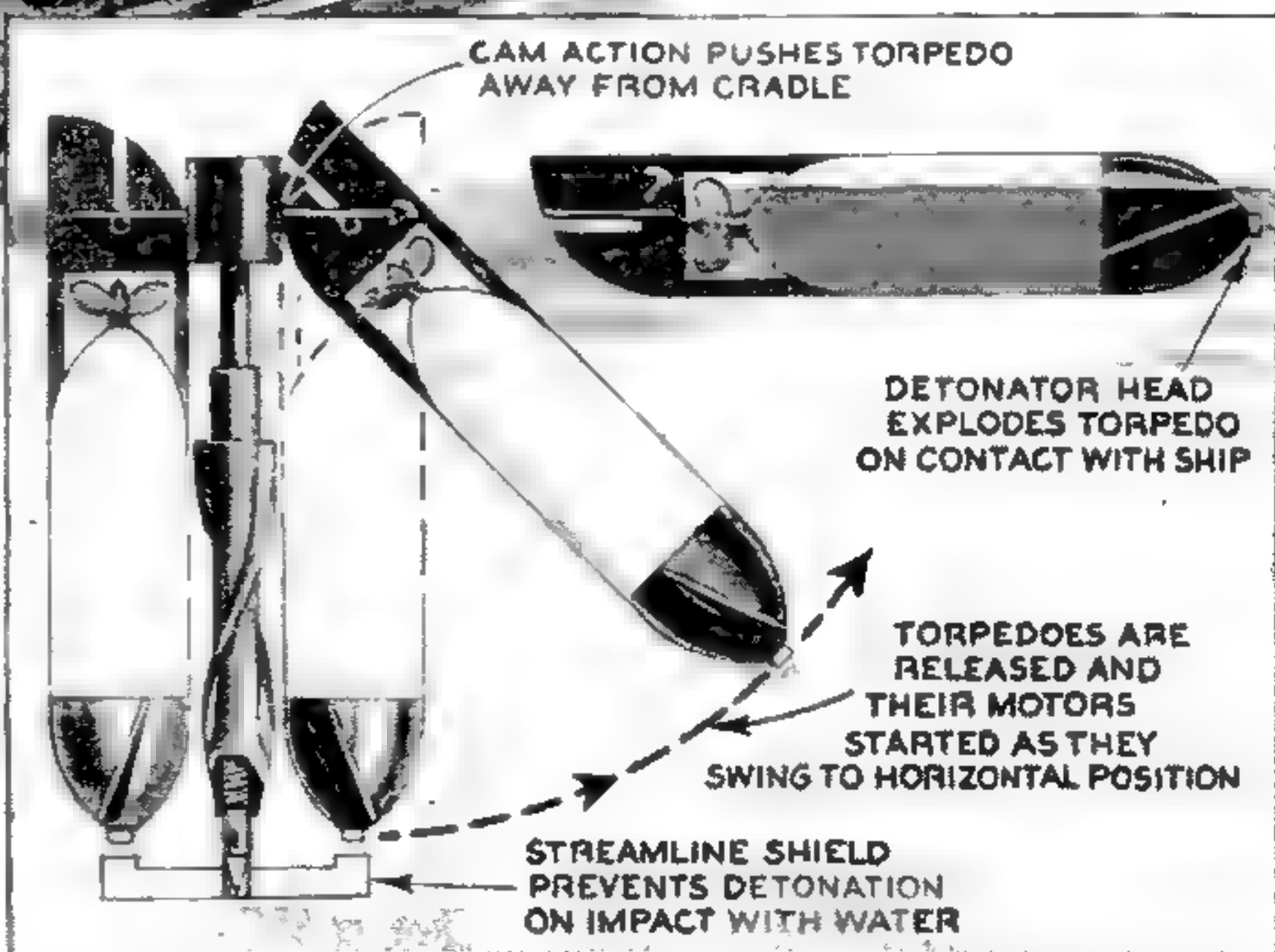
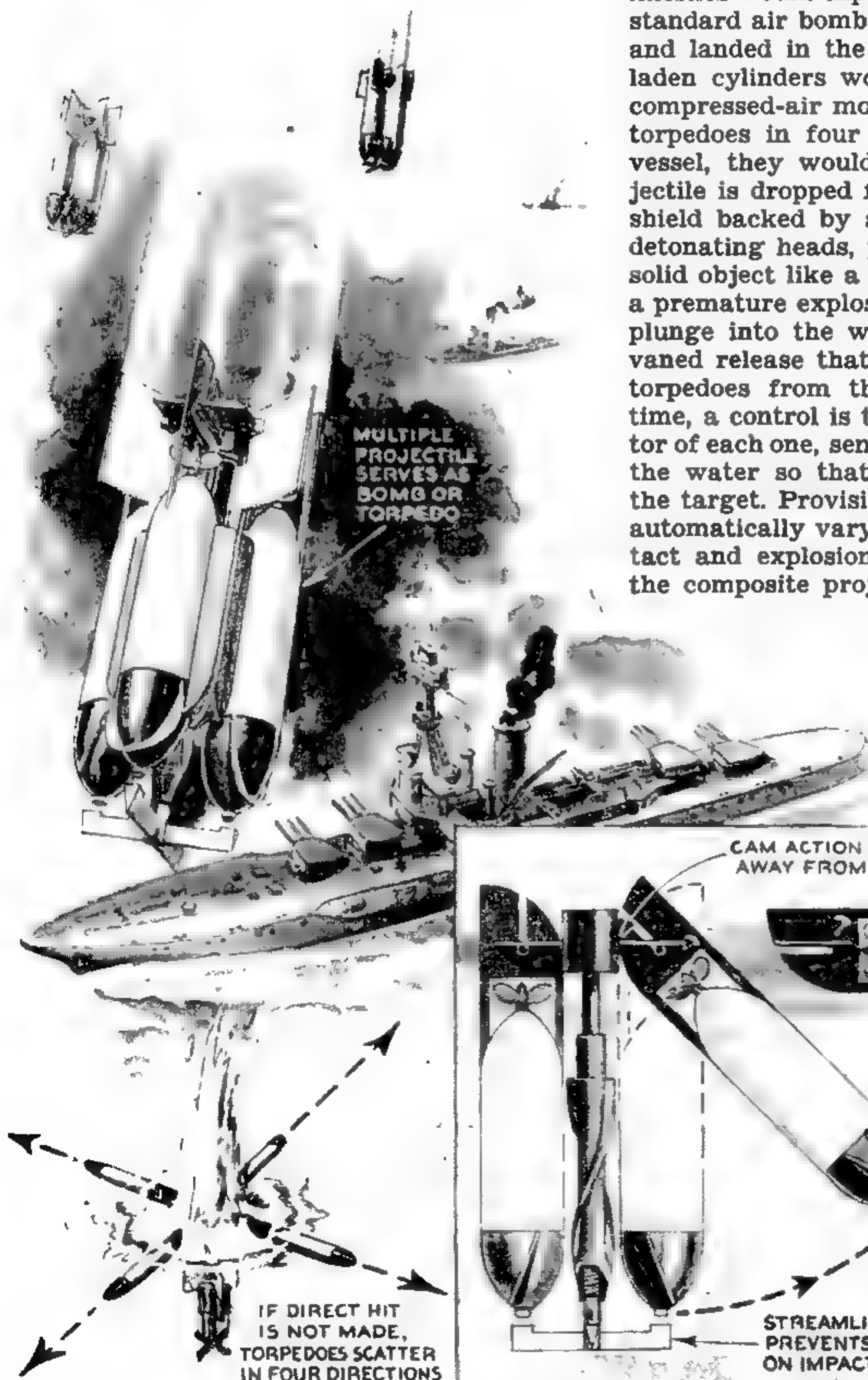
Comparing test strip with chart to show poison in air

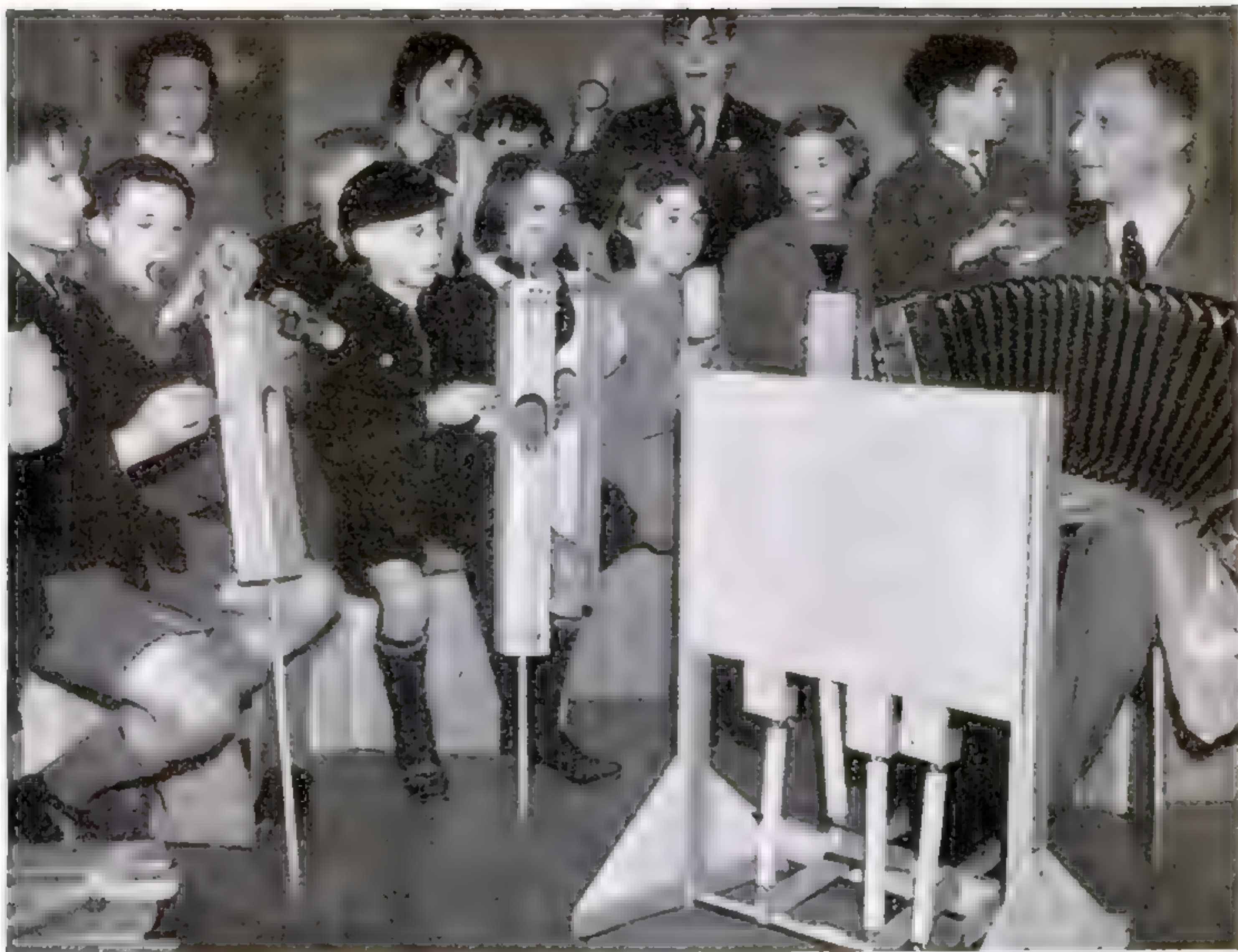


Air Bomb Becomes Four Torpedoes

TO MAKE sure of scoring a hit upon an enemy warship, an aerial projectile proposed by a Connecticut inventor would serve as both bomb and torpedo. Dropped squarely on a ship, its cluster of four high-explosive missiles would explode with all the effect of a standard air bomb of equal size. If it missed and landed in the water, its four explosive-laden cylinders would separate, and built-in compressed-air motors would propel them as torpedoes in four directions. On striking a vessel, they would explode. When the projectile is dropped from a plane, a streamline shield backed by a heavy spring covers the detonating heads, yielding on contact with a solid object like a ship's deck but preventing a premature explosion if water is struck. The plunge into the water then whirls a spiral-vaned release that unlocks and detaches the torpedoes from their cradle. At the same time, a control is tripped that starts the motor of each one, sending them plowing through the water so that one or more may strike the target. Provision would also be made for automatically varying the time between contact and explosion, to suit the dual role of the composite projectile.

If it does not score a direct hit, this naval bomb releases four torpedoes in as many directions, as illustrated in the drawings





Music Class Learns Harmony with Colors

TO TEACH children the elements of musical harmony and counterpoint, a London, England, instructor has devised the novel method pictured above. While he plays a melody on

an accordion, his pupils accompany him on special stringed instruments, each string being identified by a mark of a certain color. This enables the teacher to signal the children which string to strum, by operating a pedal indicator that displays a corresponding color. After a little practice, the pupils are able to dispense with the visual aid.



Ralph L. Bancroft displays two of his cigar-band pictures

Artistic Designs from Cigar Bands

REVIVING and modernizing an old-fashioned hobby, Ralph L. Bancroft, New York City craftsman, devotes his spare time to creating artistic decorations from cigar bands. Not satisfied with mere patchwork patterns, such as those used to decorate homemade trays, he creates pictures as ambitious in treatment as the Indian motif and the floral design exhibited at the left.

Candid-Camera Cops "Shoot" Evidence



Beverly Hills, Calif., cops equipped to take pictures day or night to aid their work. At right, an officer snaps a wrecked automobile

WITH orders to make a complete pictorial record of the scene of every crime or automobile accident, Charles C. Blair, chief of police in Beverly Hills, Calif., recently handed every motor and patrol officer a candid camera and exposure meter, and a synchronized flash-gun unit. Now every investigating law officer in the community is a photographer, ready to shoot from fifteen to thirty-six pictures when he arrives on the scene of an automobile crash, or a crime.



Fastened to the rear edge of the front door, the lock holds the rear door shut

Door Lock for Sedan Keeps Children Safe

TO MAKE sure that his children would never accidentally fall out by opening a rear door while his car was in motion, a Detroit, Mich., inventor devised the exterior safety lock pictured at the left. Installed quickly on almost any four-door sedan, and attached to the rear edge of the front door, the safety catch overlaps the leading edge of the rear door to prevent it from being opened at any time without first opening the front door. The safety catch is fastened in place by means of a set screw. A leading automobile corporation has added the unit to the approved list of accessories for installation on many car models.

Petrified Food—Free!

THESE ROCK SPECIMENS LOOK GOOD ENOUGH
TO EAT—BUT CONSIDER YOUR BRIDGEWORK!

ALL you can eat—absolutely free. That's the offer extended to all comers by Kent S. Knowlton, publisher of a California weekly newspaper, but it's not quite as generous as it sounds. For the food, tempting as it looks, is actually a collection of curious mineral specimens that resemble steak, vegetables, and various other delicacies. Some years ago, while roaming through the desert near Randsburg, Calif., Knowlton found several prehistoric oyster shells that closely resembled potato chips. Near-by, he came upon a piece of petrified Osage-orange wood that looked like a rib steak. With these as a beginning, he started an unusual hobby of collecting



FEAST OF FOSSILS

Kent S. Knowlton sits down to a full meal of rock specimens. His piece de resistance is the "rib steak" of fossil Osage-orange wood seen at the left

petrified woods, rocks, and fossils that resembled various foods. Today on a sidewalk table in front of his newspaper office, he offers a complete "meal" to visitors. On his printed menu are such items as "Last Chance Rib Steak," petrified wood found in Last Chance Canyon; "Trona Cauliflower," a lime deposit from an old mine shaft; "Baked Hubbard Squash" and "Boiled Turnips," once kelp bulbs which grew when the sea overran the desert, now hardened by time and pressure into solid rocks. Knowlton selected these extraordinary specimens from among 20,000 pieces found during fifteen years of exploration. It is perhaps the toughest food ever offered a hungry public, but the publisher provides sturdy tools: a knife and fork made by heating and shaping two lengths of steel cable.



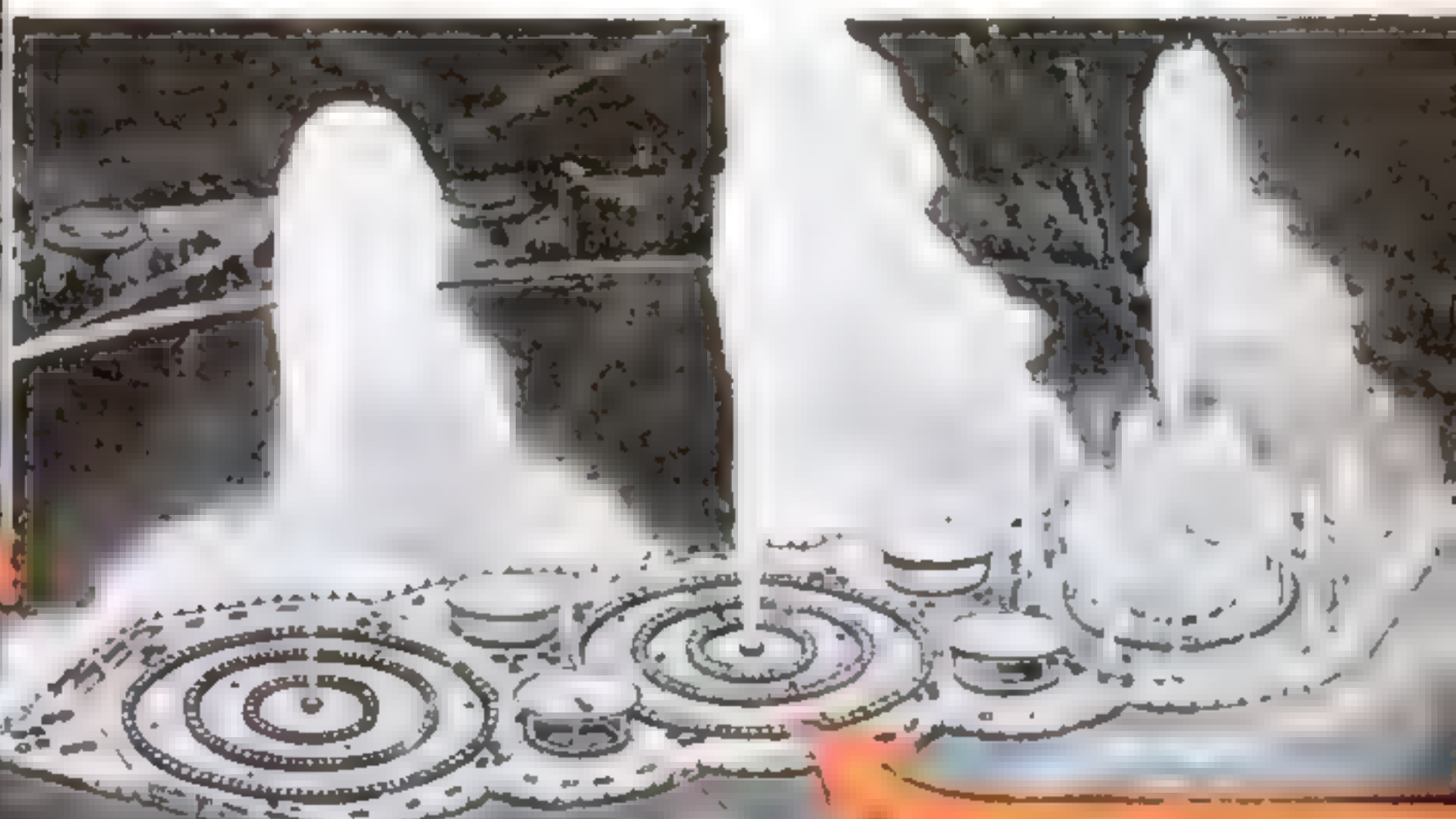
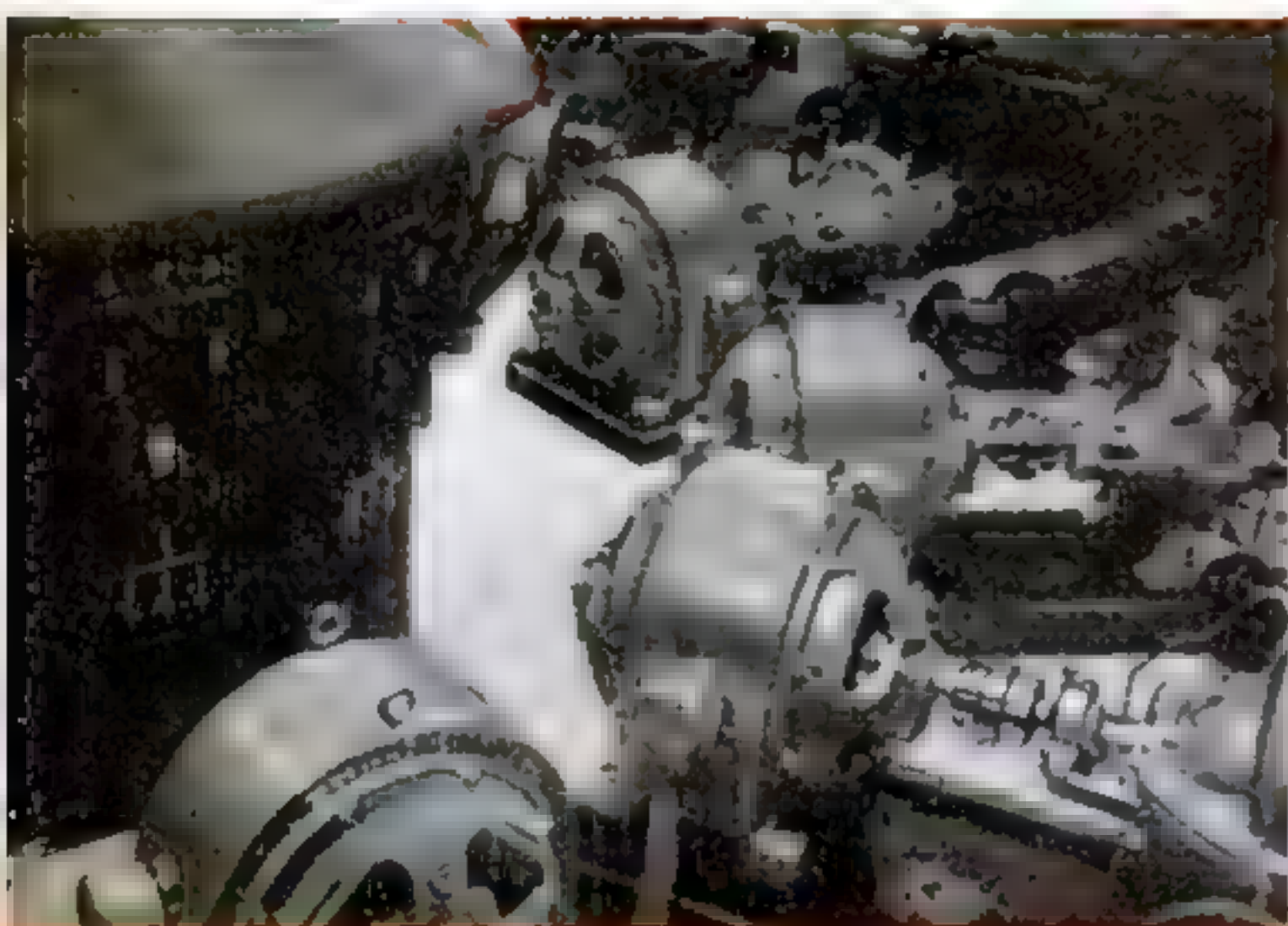
"Cauliflower," in circle, is a lime deposit. Would-be eaters are provided with special tools and mastodon teeth, right



By
KENNETH M. SWEZEY

Fountains of

The spectacular Lagoon of Nations display at the New York World's Fair, with some of the mechanical marvels behind the scenes. Inset at left shows part of the giant pumping station that supplies water. At bottom, the control room from which the elaborate performance is stage-managed



WATER, light, flame, music, and fireworks, synchronized into a vast extravaganza, are providing new entertainment thrills nightly as one of the most spectacular outdoor attractions of the New York World's Fair.

This Lagoon of Nations display centers in a giant fountain which rises from an oval lake two blocks wide by four blocks long. Water, geysering in beautiful patterns from 1,400 nozzles, is painted in constantly changing rainbow hues by batteries of powerful electric lights from below. At climaxes in a performance, towering gas flames roar through the columns of scintillating water, from more than a hundred jets. Showers of



Flame

PLAYED LIKE A PIPE ORGAN



INSIDE A MAN- MADE GEYSER

This maze of lights, pipes, and nozzles is the inside of one of the three fountains in the lagoon. Below, how outer nozzles are tilted in a twenty-degree arc



fireworks burst overhead. Stirring music thunders an accompaniment to the display from the heart of the fountain.

The whole complex mechanism is "played," as if it were some mighty organ, by three operators at electric consoles located in a near-by tower. Regular programs, based on such themes as "The Spirit of George Washington," "Creation," "Isle of Dreams," "Fire Dance," are presented to tens of thousands of spectators each evening.

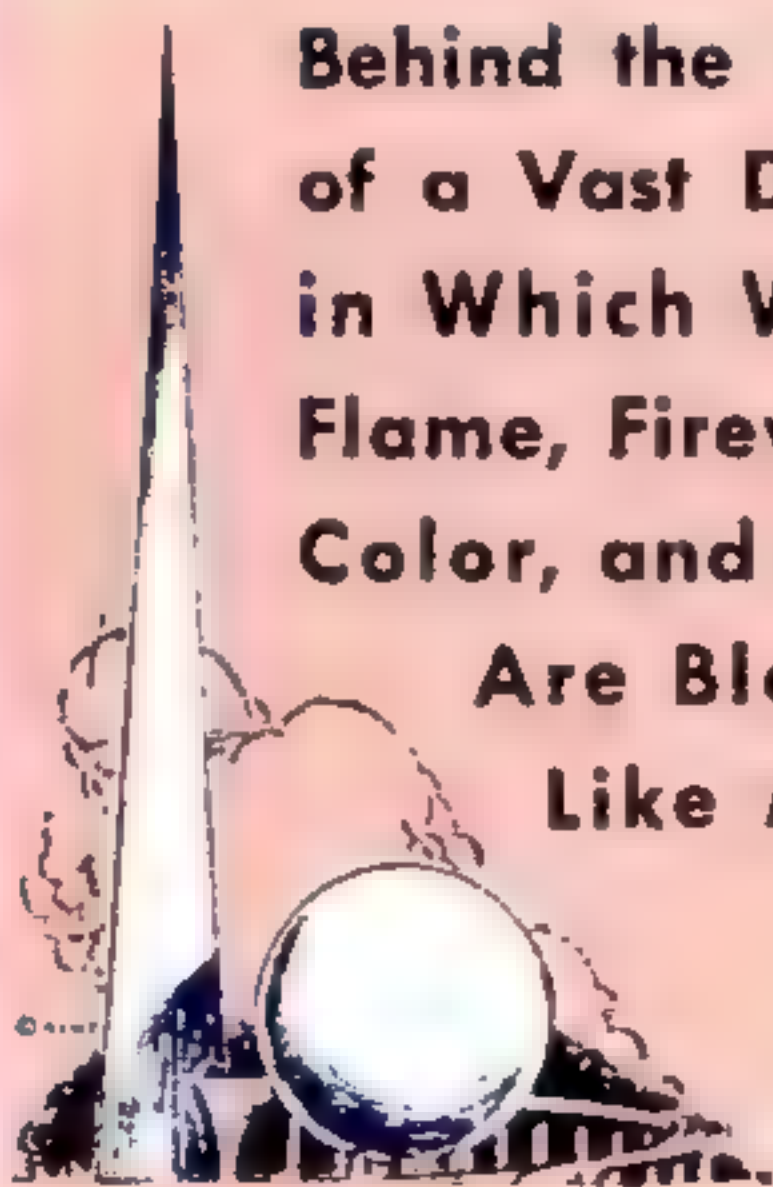
Every performance is as carefully designed, staged, and rehearsed as a Broadway show or a grand-opera production. After a theme is selected, Jean Labatut, professor of architecture at Princeton University, makes sketches indicating the desired shape and color of the fountain and noting fireworks creations where needed to express the changing moods of the theme. These sketches are given to Russell Bennett, composer, who

writes and arranges music to harmonize with them.

Next, John Craig, expert pyrotechnician, is called in to create fireworks to meet Professor Labatut's exacting demands. Not only must these explode with the colors and patterns desired, but they must be almost noiseless, so that the music may be heard above them. Their charges must also be precisely calculated so that no dangerous sparks will overshoot the lagoon.

Designing work finished, technicians translate the drawings into elaborate combinations of settings of switches, buttons, and dials. These, through valves, electric impulses, and sparks, control the fountain jets, regulate the color of the lighting, ignite gas flames and fireworks. So that sequences during a performance may be exactly timed, the settings are marked by means of symbols on long paper cue sheets which unwind

Behind the Scenes
of a Vast Display
in Which Water,
Flame, Fireworks,
Color, and Music
Are Blended
Like Magic



slowly, on rolls driven by synchronous motors, before the various operators.

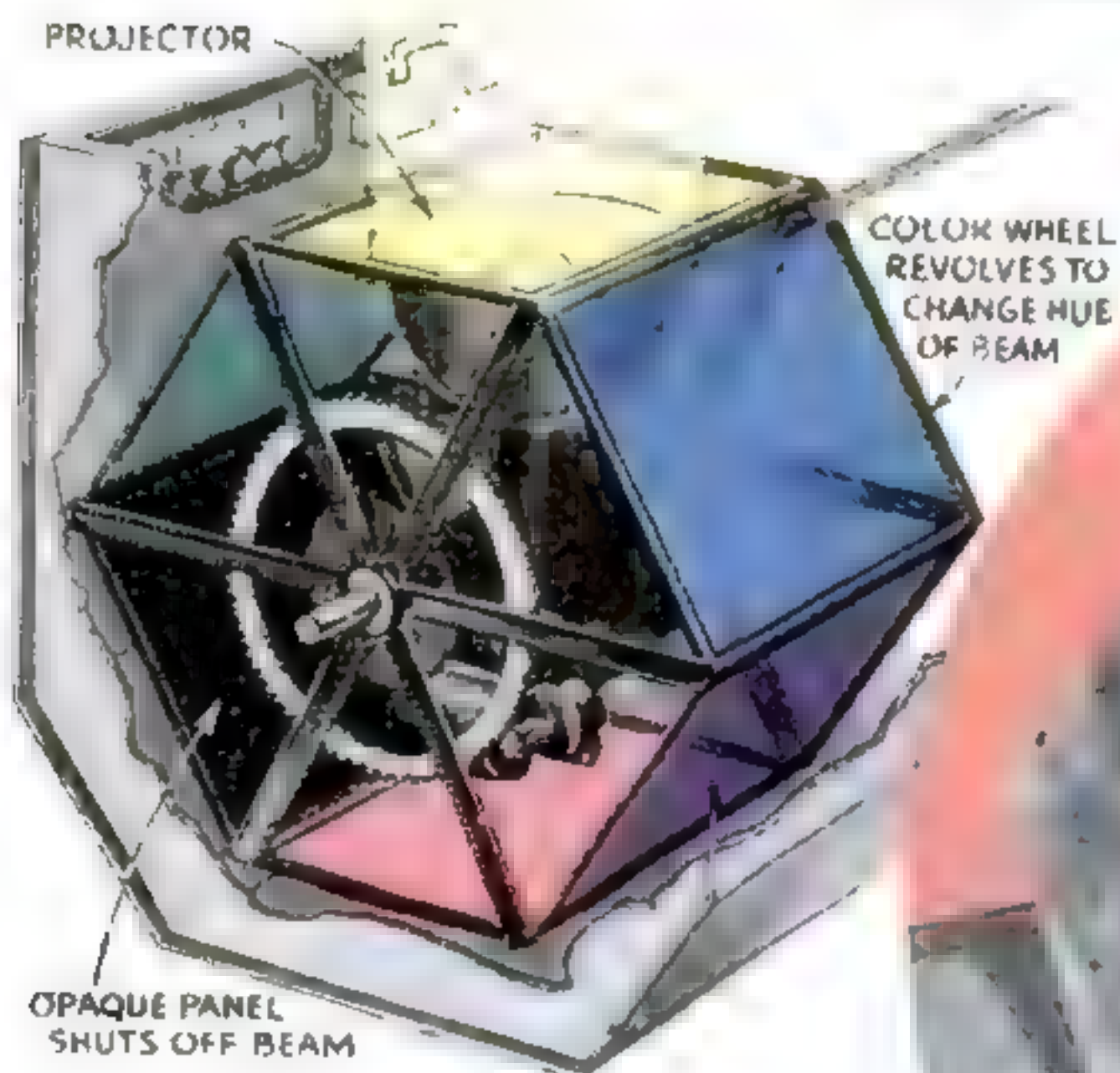
Created under the direction of Bassett Jones, electrical and lighting engineer, this powerful new instrument of entertainment cost \$650,000, and required more than a year and a half for experimental work and construction. Hydraulic engineers, gas-company chemists, fireworks manufacturers, illumination authorities, display designers, architects, color experts, and artists have all collaborated.

A quick survey of the mechanism reveals some almost incredible figures. Mounted on a 500-foot timber platform, on the bottom of the lagoon, sixteen carloads of piping and two carloads of hydraulic valves deliver water to 653 vertical nozzles, arranged in geometric patterns, and to 812 atomizing nozzles which outline the entire fountain. A 2,700-horsepower battery of electrically driven centrifugal pumps, in a circular glass-inclosed pump-room near-by, supplies these nozzles with 280 tons of water a minute.

When a script calls for it, water from a central nozzle may be spouted skyward 180 feet—as high as a fifteen-story building. Two other jets reach 150 feet, while the largest circle of nozzles, which forms among other figures a sheaf of golden wheat ninety feet in diameter and ninety feet high, can hurl its cylinder of water into the air with the force of sixty-two modern fire-fighting engines!

Lighting the water with more than 2,000,000 candle power of beautiful pastel colors is accomplished by a battery of 585 huge light-

DRAWINGS BY
B. G. SEIELSTAD



AN ARTIFICIAL RAINBOW

Color wheels like this, driven by synchronous motors, turn the spray into a kaleidoscope of pastel hues. At the right, workmen are adjusting two of the 585 big projectors





★ A SCENE TO THRILL THOUSANDS

At a climax in one of the fountain spectacles, water, flame, fireworks, and music are blended together with overpowering effect

ing drums, almost completely submerged, and by hidden searchlights that illuminate the tops of the highest jets. Each drum contains two projector units, one powered by a special 400-watt mercury arc lamp and the other by a 1,500-watt tungsten lamp. About each projector unit revolves a hexagonal color wheel, driven remotely by a synchronous motor that turns the wheel at one revolution a minute. By combining, for the first time, the spectra of the two types of light—the mercury arc extending deep into the blue-violet, and the tungsten into the red—gorgeous new pinks, blues, and crystal whites are obtained, surpassing any previously possible.

Three hundred fireworks mortars and smoke machines, touched off by electric sparks, and 135 huge gas jets capable of spurting chemically colored flames thirty feet high through the cascades of water, bristle among nozzles and lighting drums. So great is the consumption of gas by these latter jets, that two gas companies unite their facilities to supply the amount needed during a half-hour performance!

To obtain greatest realism in the audible part of the display, "canned" sound has been banned from the feature displays except for special effects. In a building several blocks from the fountain, a forty-two-piece band, an electric organ, or a fine carillon plays into two microphones separated, so as to pick up the tones from two different points. The music is timed by means of a fourth cue sheet, synchronized with the three in the control room.



How High-Stepping Cuties
Learn the Juggling Tricks
That Thrill Giant Crowds
as Modern Military Bands
Swing Past in the Parade

Strutting is an important feature of the curriculum for Fred Harry Sincock's high-stepping pupils

By
**RICHARD W.
EMERY**

School for Girl Drum Majors

THEY'VE GOT RHYTHM

Plenty of knee action helps the drum majorette to express marching rhythm. These two students are taking a marching lesson under Sincock's direction, with the roll of a drum for a text





Professional band leaders give the girls their final training. Here Herbert L. Clarke, director of the Long Beach, Calif., Municipal Band, is drilling a large class

STUDYING to beat the band is no empty phrase on the Long Beach, Calif., campus of one of the most unusual schools in the country. For here, a short march south of the nation's movie capital in Hollywood, a ruffle of drums is the rallying song of an academy for girl drum majors. In the last three years, more than 1,000 easy-to-look-at, high-stepping cuties from all parts of the United States have pranced and promenaded over the school's parade ground, learning the A B C's of spinning a baton and leading a band.

The beginnings of this novel school go back to a day in London in 1918, when Fred Harry Sincock, a young American soldier serving as an airplane mechanic, was watching a rifle-spinning exhibition by a troop of Russian Cossacks. He noticed a curious thing about the display. The heavy Russian rifles were spinning faster than he had ever seen any American drum major whirl a light baton. And instead of spinning in the conventional clockwise direction, the Cossack rifles were whirling the opposite way.

Sincock investigated further and found that instead of using both hands to twirl his rifle, the generally accepted method at that time, each soldier was using only his right hand. The rifle rolled around the second and third fingers in a half revolution, took another half turn around the little finger,

Nimble fingers, a quick eye, and a highly developed sense of rhythm are needed for baton twirling



and returned to its starting point, having completed two and a half revolutions on each round trip across the hand. That, Sincock decided, was *real* twirling, and before he headed back to the U. S. A. he mastered this new baton-twirling style.

Back home after the Armistice, he taught the new counterclockwise spin to numerous drum majors in American Legion bands, and became nationally famous himself as a master baton spinner. Then a movie producer planned a musical film that called for a corps of fifty girl drum majors, and Sincock was the man best qualified for the job of training them.

When that picture flashed across the nation's movie screens, Sincock was bowled over by an unexpected rush of girls to his Long Beach home, all wanting to learn how to twirl a baton. Some thought it

LEARN TO TWIRL A BATON!



Start of the finger roll, basic twirl of the drum major's art. As viewed by the performer, the baton revolves counterclockwise



In a quarter revolution, the wand rolls over the two center fingers and is entering the space between third and little fingers



Most dangerous of the drum major's stunts is the high pitch. A slip may mean a cracked head

would help them to land movie jobs. Some wanted to be drum majors so that they could lead college bands or head home-town parades. And some just wanted to learn to spin the bar for the fun of it. To meet this demand, Sincock started his novel school.

Baton twirling, his girl students find, is as full of tricks as baseball pitching, demanding speed, control, and poise. The band leader's stick is like a metal baseball stuck on the end of a bat. When it spins, air pressure makes it curve out of its true path. And when it is whipped high into the air, it wriggles down along a crooked path that calls for perfect timing on the part of the drum major who tries to catch it. If timing is a split second off, look out!

For although a glittering baton spun by an expert looks light as a feather, it is a thirty-six-inch brass tube, finished at one end with a hollow brass knob and at the other with a solid brass tip. It weighs from eighteen ounces to two pounds, and, whirling at four revolutions a second, it can give a luckless spinner a skull-cracking wallop.

Over and over again, in her first lessons, a rookie drum major must practice tossing the baton from one hand to another smoothly and with no interruption in its spin, whirling it from the thumb of her left hand and catching it at just the precise moment in her right. Early in the game, she must practice picking up a dropped baton with a tricky flip of her foot, so that she won't be too embarrassed if it clatters to the pavement in front of an admiring crowd.

Eventually the fledgling band leader learns to synchronize her steps and twirling with the music, and to perform all kinds of acrobatics as she nonchalantly twirls the stick. One of the most spectacular of the stunts that Sincock teaches—the high pitch—always

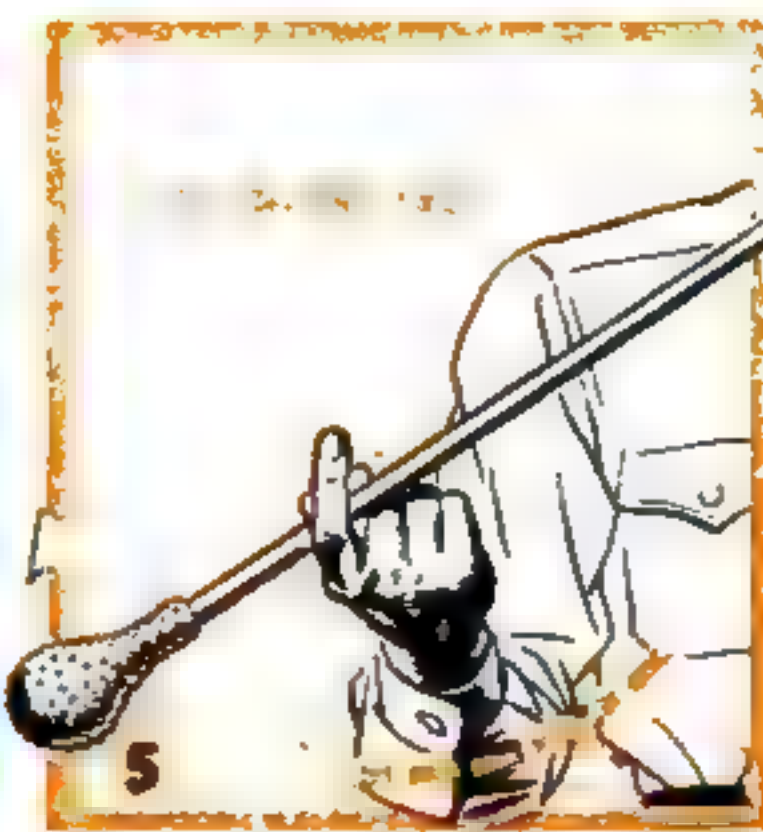
THESE SIMPLE DRAWINGS SHOW YOU HOW



While the baton is rolling around the little finger, the hand is turned over to give the stick a twist and keep it spinning smoothly



Here the baton has slipped free from the little finger and is turning unheld in the air. The hand turns over quickly for the catch



Caught between the first and second fingers, the baton is now back in the original position after nearly two revolutions

hand, catches the baton, rolls it over into a finger grip, and, still smiling and still in step, proudly starts another series of dazzling twirls.

But if something goes wrong—if she trips, stumbles, or loses her timing—well, she may be able to flip the fallen baton up with her foot and try again, or she may be taken home with her head in bandages.

After a final period of training under a professional band leader, pupils

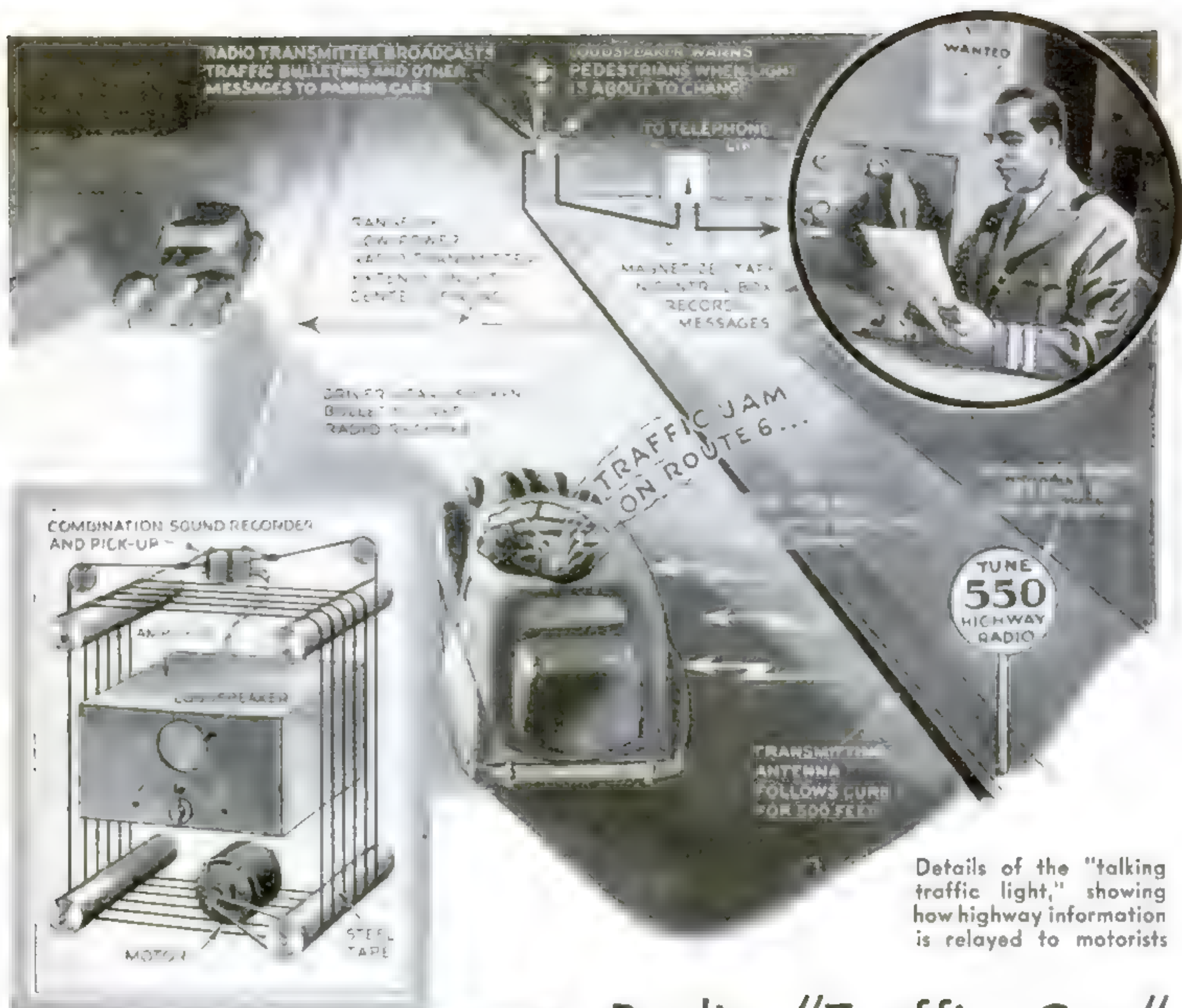
brings rousing cheers from parade crowds but is by far the most hazardous for the girl drum major. In this tricky baton cast, the girl must time her steps and spinning to the quarter second. With a flip of her wrist she hurls the spinning baton high over her head.

All eyes of the crowd are on her as she watches that gyrating baton stop its upward movement and begin its plunge down. At the split second when the descending bar is shoulder high, she snaps out the palm of her right

are ready to grace any kind of parade, from a welcoming procession up Main Street to an American Legion national convention march through the heart of an American metropolis.



TWIRLING AND MARCHING at the same time requires some practice. These girls are learning to synchronize their steps to spinning batons



Details of the "talking traffic light," showing how highway information is relayed to motorists

Radio "Traffic Cop" Cautions Motorists

TESTED experimentally in New York City not long ago, a "talking traffic light" offers a fascinating preview of motoring in the future. Miniature red and green lamps on a car's dashboard, controlled by radio from the new highway beacon, reproduce its "stop" and "go" signals so that a driver need not take his eyes from the road to see them. A warning tone signal accompanies a change of lights. Meanwhile the motorist's radio receiver picks up vocal traffic bulletins and safety instructions, recorded on a magnetized steel tape and broadcast repeatedly from a short-range transmitter through a 500-foot antenna stretched along the curb. By remote control from a central point, one recorded message may be "erased" from the tape and another substituted. When a driver enters a "radio zone" where the talking traffic lights have been installed, a roadside sign gives him the dial setting to tune in the signals on the receiver in his car.



This is the automatic transmitting unit of the system. Its construction is illustrated in the drawing



Mattress Doubles as Life Raft

TAKEN into the wilds on fishing and boating trips, a new "unsinkable" mattress provides safety as well as comfort, for it can be used as a life raft in case of emergency. Made of kapok floss, the mattress will support four people in the water, according to its maker. Its weight of only thirty-seven pounds minimizes the load to be carried. The photograph above shows a striking demonstration of its buoyancy before interested sportsmen at a Sharon, Mass., rod and gun club.



Nipple Attacher for Baby Bottle

EASILY sterilized, a plier-like device now available makes it possible to place a rubber nipple over the neck of an infant's feeding bottle without touching the rubber with the hands, thus insuring complete sanitation. How the device operates is pictured in the photograph at the left.

Match Dwarfs World's Smallest Electric Motor

COMPLETELY dwarfed in comparison with an ordinary kitchen match, a Lilliputian electric motor constructed in Switzerland by Ferdinand Huguenin is said to be the smallest in the world. Rated at five thousandths of a watt and driven by a two-volt battery, the tiny engine employs forty-eight separate parts, including pieces of platinum and two rubies.

Compare the size of the electric motor below with the head of a kitchen match





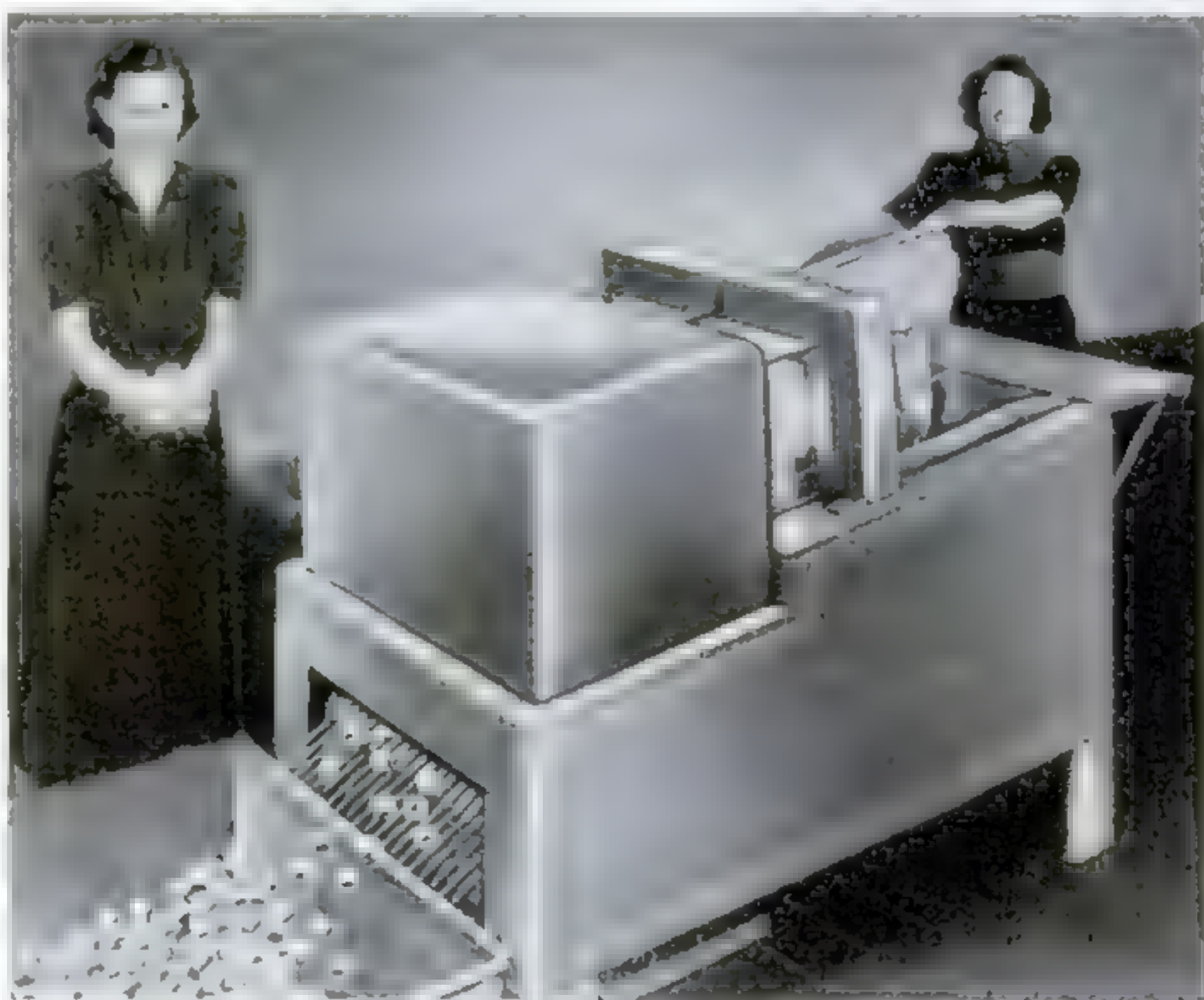
Air-Raid Vault Uses Chain of Gas Masks

LIKE smokers grouped around a Turkish bubble pipe, users of a new French air-raid shelter inhale from a common source. Tubes connect their masks with a single pipe leading from a battery of oxygen cylinders, as

shown above. Thus they are constantly assured of pure air to breathe, without recourse to poison-absorbing canisters that hinder free respiration; and elaborate gasproofing precautions may be dispensed with.

Steam Slices Ice Cakes into Cubes

STEAM replaces saws and machinery in a novel steam cutter that makes ice cubes in quantity lots. Hundred-pound blocks of ice are fed onto a grid within an inclosed steam chamber. The grid, which consists of steam-filled tubes, slices through the ice, first in one plane and then in a second and a third, transforming the solid block into hundreds of standard-size ice cubes, which tumble into a metal bin below the outlet of the cubing machine. The steam cutter pictured at the right turns out 35,000 cubes an hour. Smaller models are available.



Steam-filled tubes within the machine replace saws to cut ice cubes



Right, "packing" the 'chute. Tossed aloft, the ball opens, releasing the parachute

Ball "Bursts" in Mid-Air — Releases Parachute

THROWN high into the air, a "magic" rubber ball now available in toy stores opens to release a tiny parachute which floats it gently down to the ground. Made of pure silk and attached to the ball by means of strings, the parachute is stuffed into one half of the ball, the other half is then bent over the first, the strings wrapped around the joint, and the rubber toy, now ball-shape, is tossed into the air. When the strings unwind, the ball flies open.

Cut-out pictures are pasted on top of each other, giving a three-dimensional effect



Build-Up Nursery Pictures

CHILDREN can now make pictures of animals, birds, airplanes, and other objects with novel colored paper units designed so that the finished picture has a three-dimensional effect. Starting with one pictorial unit as a background, sections are added one unit at a time until the illustration is completed.

Facial Cream Stays Fresh in Individual Capsules

FACIAL CREAM is now being packed in small, sealed capsules, each containing the exact amount necessary for one application. Designed especially to prevent the cream from spilling, aging, or evaporating, as might be the case if it were packed in conventional jars, the capsules are broken open into the of the hand with a squeeze of the fingers, as shown in the photograph below. The cosmetic is then applied to the face like any other facial cream.



Squeezing the capsule ejects the cosmetic for use

Century-Old Camera



With an ancient camera found in an old attic, Robert N. Dennis snapped the photo, top, of New York City's famous Aquarium

Compare it with this daguerreotype, made when the Aquarium was Castle Garden



Exposures, once made as at top by removing lens cap, are now made with a fast shutter

By EDWIN TEALE

COVERED with dust and dumped higgledy-piggledy into a box of odds and ends, one of the first cameras ever used in the United States was discovered recently in a New Jersey attic. Almost 100 years ago, it produced some of the first "tintypes" seen in this country.

To commemorate the one hundredth birthday of photography, which the world is celebrating this year, Robert N. Dennis, a New York amateur, bought and renovated the ancient daguerreotype machine. Through its lens, he is photographing skyscrapers and other modern wonders undreamed of in the days of Louis Daguerre.

It was Daguerre, a Parisian scene painter, who

Snaps Modern Scenes

startled the world, 100 years ago, with the announcement that he had succeeded in "painting with light." In the ten amazing decades that have followed, photography, the art which he introduced, has risen to a position of first importance. This advance is dramatized by Dennis's pictures.

With its huge lens, its brass fittings, and its heavy wooden body, the pioneer picture-making mechanism he is using weighs as much as an average eight-year-old child. It is equipped with two hinged doors which permit the insertion and removal of plates or cut film. To focus the camera, the operator turns a crank on the right-hand side of the box. This moves an inner sliding shell to carry the film nearer or farther from the lens.

Almost as odd as the camera itself is the tripod which supports it. The three legs are ornate with beads, evidently the product of a furniture lathe. At the top of the central supporting column is the great-granddaddy of all tilt-tops. Two flat wooden sections are



Here's a view of Manhattan's skyline made on modern film with the century-old "lens box"



Shaded areas around the pictures are caused by a diaphragm installed on the old lens by Dennis, shown above with his antique camera



Note the focusing crank on the side, and the wooden screw that raises the tilt-top head mounted on the sturdy old wooden tripod

hinged at one end. The camera rests on the top section, prevented from sliding off by molding running around three sides of the support. Projecting up through the lower section, at the end opposite the hinges, is a long wooden thumbscrew. By turning this, the operator can lift the end of the top section, pointing the camera down, or—when the lens is facing in the other direction—up, at any desired angle.

Originally, the ancient camera was equipped with neither a shutter nor a diaphragm. Picture-making plates of its day were so slow that exposures were made by removing and replacing the lens cap. A few seconds one

ly the same as it was when used for the first time, nearly a century ago. Transporting the giant box camera in an automobile, and taking along a friend to help set it up, Dennis has recorded through the ancient lens clear pictures of the New York skyline, of ships going down to the harbor, of metropolitan landmarks that were in existence when Daguerre made his long-ago announcement and the art of photography was born.

The story of that announcement and of the years of struggle that preceded it is an epic of human courage. It is also a tale of lone-handed research rarely equalled in history.

In the very year that the French Revolution began, Louis Jacques Mandé Daguerre was born in a little village near the mouth of the Seine. As a child, he ran neglected and ragged through the streets. Setting out for Paris as a young man, he entered the capital almost penniless and without friends. Yet, by native ability alone, he soon became the leading scene painter of the French stage. His mechanical effects were the talk of the town. He was growing wealthy and famous, when he retired to a little home laboratory to spend nights and days mixing ill-smelling chemicals and fitting together curious mechanisms.

His wife feared he was losing his mind and consulted a physician. His



Two famous New York institutions, photographed by the century-old device: Cooper Union in foreground, and the huge Empire State Building



LOUIS DAGUERRE
who 100 years ago succeeded for the first time in "painting with light," marking the beginning of photography. At right, typical daguerreotypes taken by cameras like Dennis's



friends lamented the end of his brilliant career. Yet, with money dwindling, Daguerre kept on year after year seeking to realize a seemingly impossible dream. Oftentimes, in his work as a painter, he had used the "camera obscura," a light-tight box equipped with a lens and viewing screen. This device had been introduced centuries before by the Italian philosopher, Giambattista della Porta. The dream of Daguerre was to make permanent the images he saw on the viewing screen.

Other experimenters had tried to achieve the same end, with scant success. A retired soldier who had fought with Napoleon in the Italian campaign, Joseph Niepce, had actually obtained a faint image of a pigeon coop by using a metal plate coated with asphalt dissolved in sweet-smelling oil of lavender. But the exposure had lasted from morning until night.

Daguerre tried iodized silver plates. They, too, demanded impractically long exposures. When, apparently, he had wasted years of his life, a stroke of luck brought success. He had tossed a plate that showed only the faintest trace of an image into the cabinet where his chemicals were stored. The next day, he was dumfounded to see a perfect image on the sheet of metal. He put another underexposed plate in the cupboard. Again, after a lapse of twenty-four hours, the image became distinct. There were dozens of chemicals in the magic cabinet. Which one was bringing out the image?

One by one, Daguerre made tests with each of them. Finally, he traced the effect to the



fumes of spilled mercury. It brought out the latent image and made the long exposures of the past unnecessary. That accidental discovery enabled Daguerre to cut the exposure time from hours to minutes and make photography practicable.

Now, a century later, photography has become a leading hobby of the world. In this country alone, more than 15,000,000 cameras are in use. But none of them, it is safe to say, is stranger than the huge apparatus with which the New York amateur, Robert N. Dennis, is carrying on his one-man celebration of Daguerre's dramatic achievement.

Statues Pay His Way Through College



Sulo Harju coating C.C.C. statues with bronze. Some are left white under clear lacquer, as shown below



WHEN lack of funds forced him to quit his studies at the University of Wisconsin, twenty-two-year-old Sulo Harju, of Redgranite, Wis., refused to give up hope of a college education. He set to work making souvenir statues of Civilian Conservation Corps workers, which find a ready sale at C.C.C. camps. Through this novel enterprise he expects to earn enough money to complete his course. A shop on his parents' farm serves as a factory for his molded plaster-of-Paris figures. Some of them get a bronze coating, while he leaves others white beneath a clear lacquer finish.

Lights on Map Show Air-Mail Flying Time

AN ILLUMINATED map of the United States, installed at West Palm Beach, Fla., emphasizes the timesaving advantage of sending letters by air. Figures light up to show the time at which air mail, leaving this post office at 8:30 p.m., will arrive at any given city, when a patron touches an electrified pointer to a corresponding contact on the map. In the photograph at the right, the novel map is being used.



Touching contacts with a pointer lights up figures to show time of arrival



Nut Pickers Ride Aerial Cars

THREE men riding in aerial cars knock down walnuts from the biggest trees, when the unique harvesting machine of a San Ramon, Calif., orchard contractor goes into action. Mounted on a tractor that slowly circles each tree in turn, a thirty-foot steel tower supports the harvesters and their strange rig, as above.

Rubberlike Compound Is Made from Milk

NEW wealth from dairy products is promised by a process for making a valuable rubberlike substance, just developed by the U. S. Bureau of Dairy Industry. The raw material, whey, is a by-product in making cheese from whole milk, or casein from skim milk. Chemical treatments convert the whey into lactic acid and then into the final, semisolid product, which is known to chemists as "polymethylacrylate." Fabrics of all kinds may be made water-resistant by impregnating them with this transparent, water-white compound, which also is expected to find uses in varnishes, inks, and cements.



These samples show how the substance bends and compresses

Hoodlike Gas Mask Protects Babies

THREE years of research have solved the grim problem of fitting babies with gas masks, according to the British designer of the model illustrated in use below. Rubberized gasproof fabric completely incloses an infant from the waist up in a capacious hood with a large cellulose acetate window. A hand bellows operated by the parent supplies pure filtered air for the baby to breathe.



Pure air is fed to this infants' gas mask by operating the bellows with the hands

Volunteer Flying Cops

AID THE LAW



Sheriff's Aero Squadron of Los Angeles County, Calif., drawn up for review. At the left is the badge worn by members of the unique organization

CIRCLING over the California foothills, an airplane suddenly swooped low. The pilot leaned far over and peered down at a black sedan slithering around the curves of a road below; then he jerked the ship upward and reached for his microphone.

"Have located 'bandit' car, heading up Mint Canyon!"

On the skyline, a dozen moving specks veered, fell in line behind the leader, and headed back toward distant Los Angeles. Up nosed a fat dirigible, spotted the fleeing automobile, and paused, motionless, over the canyon. Five miles away, a cruising radio car caught the message from the sky, swung, and headed back toward the mountains. Another, farther up the canyon, drew to the side of the road and two deputies stepped out.

As the "bandit" car came careening around the corner, the uniformed deputy behind its wheel saw his fellow officers and pulled up to a screeching stop. The mimic man hunt was over, the "desperadoes" located. Again

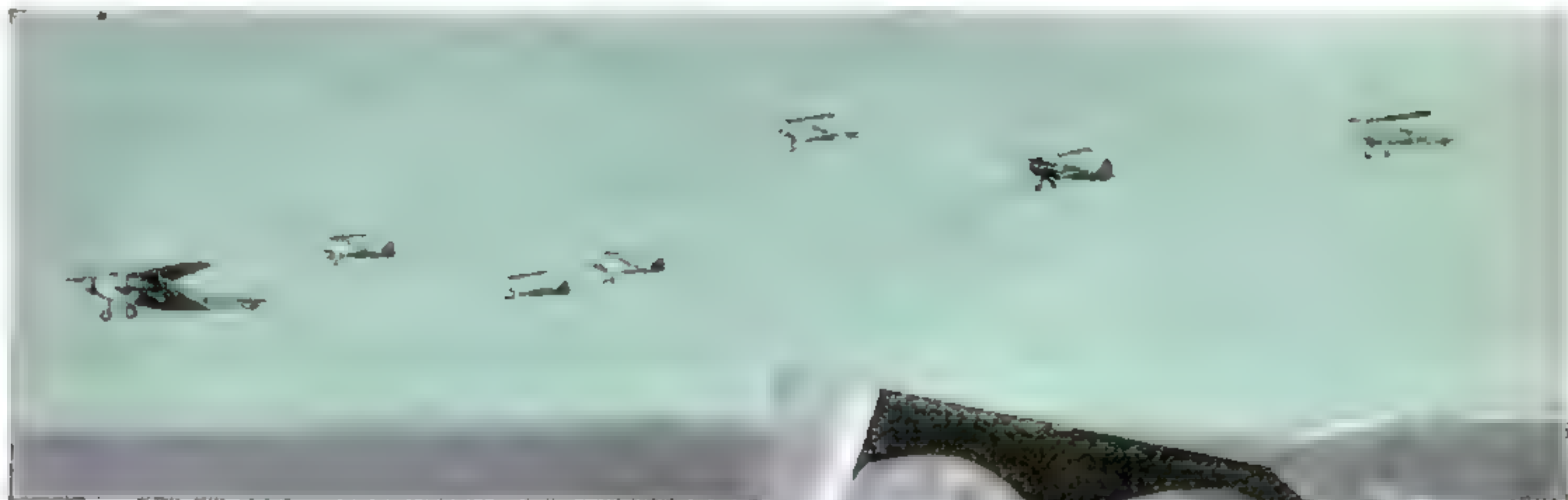
the sheriff's Aero Squadron had proved its worth.

Four times a year, practice maneuvers like these train members of the West's first flying posse for their job. Sixty volunteer airmen—Army, Navy, Coast Guard, and civilian flyers, test pilots, and movie stunt men—now aid the sheriff of Los Angeles County in patrolling an area almost as large as Connecticut, nearly half of it mountain and desert. Theoretical flight problems like the Navy "war games" give them practice in spotting lost airplanes, "bombing" rescue camps with parachute loads of supplies, or drawing aerial dragnets to capture fleeing criminals.

In one such test, a pilot set down his plane in a secluded spot unknown to the others, then radioed a brief message:

"I'm down in the mountains with engine trouble—come and get me!"

Within twelve minutes, one of the thirty-seven ships that immediately took up the search had located the lost pilot, thirty



SHERIFF'S POSSE—ON WINGS

Squadron ships in flight to search for a lost transport plane. At the right, Sheriff Eugene Biscailuz is directing flyers by radio from the cabin of the blimp "Volunteer," an auxiliary unit



miles away from the starting point.

Again, squadron flyers took off from Grand Central Airport after a radio flash that a major disaster had theoretically wiped out the desert town of Lancaster and that all communication lines were down. A hurriedly formulated flight plan assigned a given patrol area to each pilot. Before dawn, Red Cross workers accompanied by troops of Boy Scouts had driven to four secretly chosen spots where, stretching strips of white cloth upon the ground, they spelled out code messages signaling the needs of "refugees."

Within an hour, all four camps had been located, their needs radioed to headquarters, and squad cars were speeding to the rescue with theoretical food, blankets, and even five (theoretical) boats, as requested in a special message designed to test the accuracy of the spotters.

The squadron was organized shortly after the Long Beach earthquake of 1933. At the time of that disaster, a radio-equipped plane flew over the devastated area by moonlight and brought back a clear picture of the acres of ruined buildings, the crowds of refugees, and the rescue activities being carried on under the glare of Navy search-

lights by seamen from the U. S. Fleet. Sheriff Eugene Biscailuz saw the value of such an organization in future emergencies and had Capt. Claude F. Morgan organize a volunteer body like the old-fashioned western posse—with wings.

Membership is by invitation only. The flyers not only serve without pay, but also furnish their own planes, uniforms, and even the gasoline and oil for squadron flights. A supply officer and a ground crew of six manage the equipment—blankets, message bags, parachutes, and even a wind sock for emergency landing fields. An engineering officer has tools ready to give quick service, and a parachute technician sees that the 'chutes are kept ready for instant use.

Lighter-than-air branch of the squadron is the Goodyear airship *Volunteer*, a 148-foot, five-passenger dirigible piloted by Capt. A. T. Sewell. Because of its ability to hover over dangerous terrain, the blimp usually takes the lead in searches for lost persons. Since it joined the squadron, it has flown over the waters of a near-by bay to locate victims of a fishing-boat explosion; combed a canyon for two lost Boy Scouts until one was discovered clinging to the side of a cliff whence the other had fallen to his death; dropped 250 pounds of food, including eggs, and oats for

By
STERLING GLEASON

the donkey, to a rancher stranded by storms in the mountains; and frequently helped life guards look for the bodies of swimmers or amateur yachtsmen drowned off the beaches.

Once the blimp's pilot sighted a small boat aimlessly adrift, dropped within shouting distance, learned the occupants had been drifting several days without food or water because of engine trouble, and summoned a Coast Guard cutter to the rescue. Another time, he spotted a stolen car and followed it about until police prowl cars could catch up with the fleeing thieves.

The flyers help in policing air meets and races, report air traffic violations, watch for stolen planes, investigate air accidents, and occasionally form aerial escorts of honor for visiting dignitaries. Associated with the squadron is the Aerial Nurse Corps of America, with a local unit of forty trained nurses who

A pilot receiving a package of food to be dropped for flood refugees. Below, packing food and medicine



HELP WANTED

Flood survivors huddled on an island signal to the rescue plane with strips of cloth laid on the ground. The letter "T" in the squadron's code means that food is needed for fifty people

have flown much and do not get airsick. Another affiliate is the "Avion" group, comprising young student flyers of sixteen to twenty-one years, who volunteer their services when needed. In emergencies, a communication reserve of radio amateurs coöperates with a short-wave network tying up with the central transmitter at squadron headquarters.

During the disastrous 1938 flood, when hundreds of persons were marooned in the mountains without food, the aerial squadron set up emergency headquarters at Grand Central Airport. One by one, flyers took off under lowering skies to cruise over the flooded countryside on errands of mercy.

Down through Big Tujunga Canyon, where torrents had ripped out all roads, a man struggled all night through a wilderness of huge boulders and tangled debris to report that 150 men were isolated in a camp high up in the hills. Flying over the spot, a pilot dropped a streamered canvas message bag bearing a signal code for establishing communication. With sheets laid out upon the ground, the refugees spelled out an appeal for medical supplies. The pilot radioed the message ahead and returned immediately with the needed equipment, which went fluttering down under a parachute to save the lives of a number of pneumonia-stricken refugees.

As the scope of the disaster was realized, Navy and Coast Guard cooperation brought more flyers to help. Big Navy bombers droned over the mountains, their bomb racks loaded with five-gallon cans of milk or kerosene attached to parachutes. Half a dozen times daily, Coast Guard amphibians landed on a rain-swollen lake behind one of the big dams, bringing food to hundreds of refugees and carrying out injured persons.

Over isolated districts the Aero Squadron cruised, flying up nar-

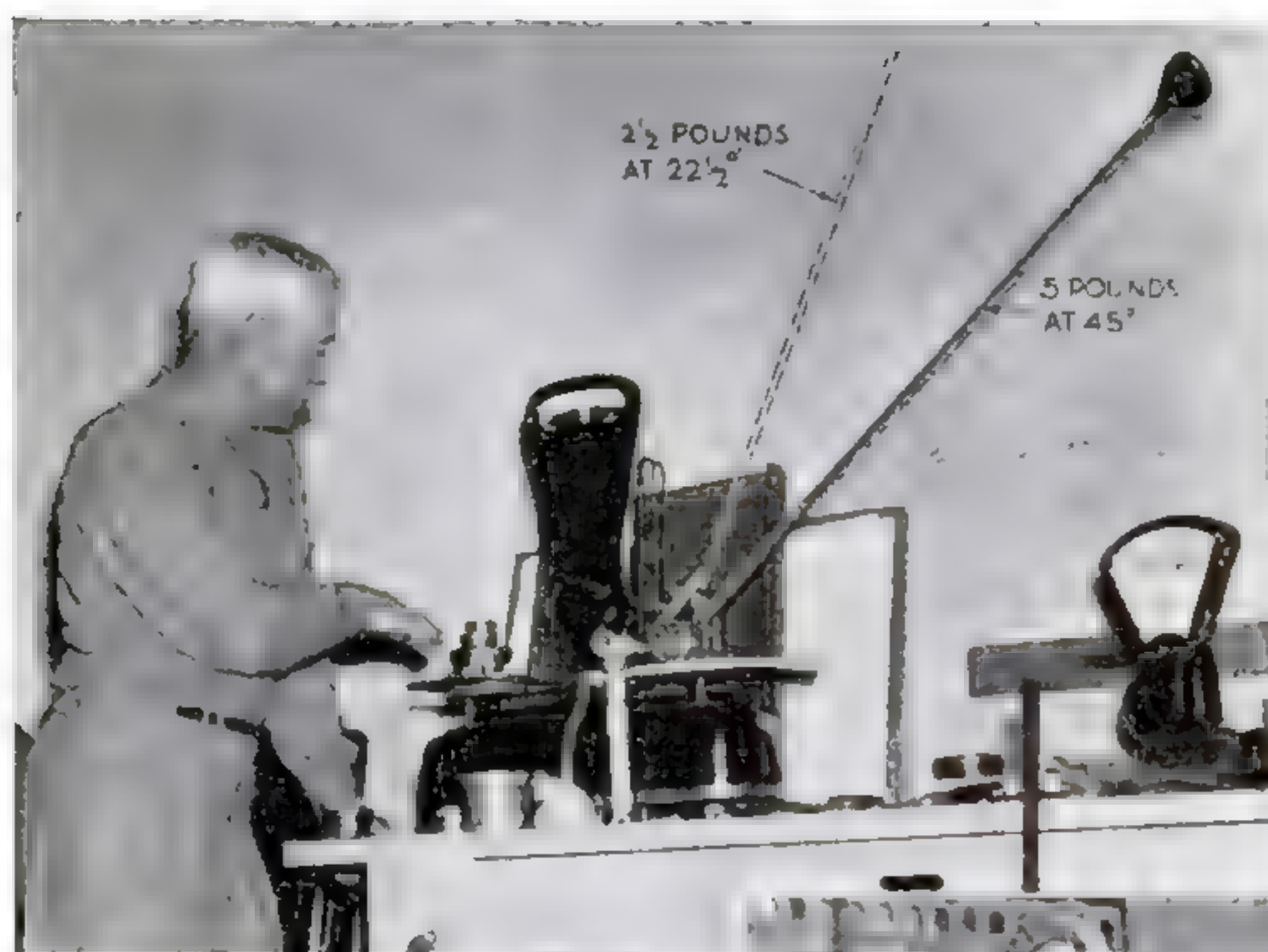
row canyons in the face of dangerous down-drafts that at times swept planes within fifty feet of the ground. Men signaled to them with sheets, with mirrors, or waved their arms to attract attention. Food by the truckload was rushed to the airport and packed for aerial dispatch. When parachutes were gone, heavy wrappings of blankets cushioned the packages so that all safely reached their destinations. During the nine days after the flood, the squadron flew hundreds of miles, dropped tons of food, medical supplies, bedding, and even grappling hooks and plumbing equipment, aiding rescue workers in saving many lives and proving the value of this modern posse with wings.

Organized when a disaster pointed out the great potential value of such a group, these flying cops keep their planes and equipment in trim, and themselves ready at all times, to respond to any emergency call.

At the right, Capt. A. T. Sewell is commanding the blimp "Volunteer" in a rescue flight. Below, the lighter-than-air craft is bringing aid to a boat in distress. The dirigible is specially valuable in searching mountainous country because of its ability to hover above dangerous terrain



Novel Scale "Weighs" Golf Swing

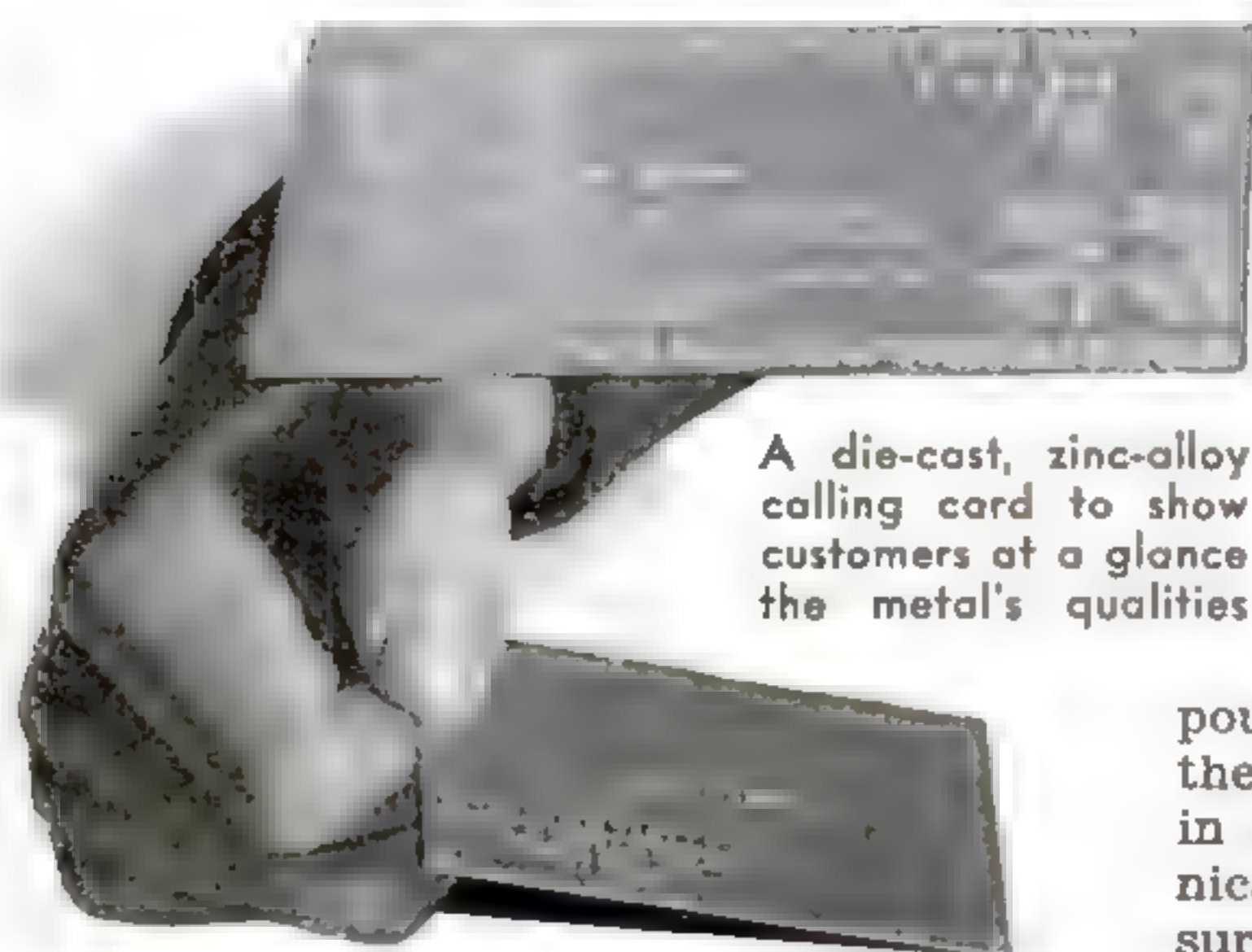


vealed, a fourteen-ounce club "weighs" about two and a half pounds. At forty-five degrees, the angle adopted by most average players, the club "tips the scales" at five pounds, just twice as much. When the ball is driven with a club held at the lesser angle, Sargent points out, the golfer assumes a natural stance with his weight on his toes, and the reduced "weight" lessens the tendency of the club head to twist or turn over at the moment of impact.

WHAT is the most important factor in the swing of a champion golfer? After eight years of study, George Sargent, Atlanta, Ga., professional, has decided that it's all a question of the angle between the golf club and the golfer as the ball is struck. From close scrutiny of moving pictures of various golfing stars, Sargent discovered that most champions hit the ball at an angle of about twenty-two degrees, and, through a weighing machine of his own devising, he estimated what a variation in the angle does to the effective weight of a swinging club in a golfer's hand. At the ideal angle of twenty-two degrees, the machine re-



George Sargent, golf expert, shows the right and wrong stance. With the apparatus above, he found out that the correct angle between club and body for the best swing is twenty-two degrees



A die-cast, zinc-alloy calling card to show customers at a glance the metal's qualities

Calling Card Introduces Salesman—and Product

CALLING CARDS made of metal introduce salesmen for a new zinc-alloy product to prospective customers. Paper-thin, each card bears on the reverse side data on the composition and properties of the metal, while the card itself illustrates the precision that is now attainable in zinc-alloy die casting. A pressure of 4,800 pounds to the square inch is required to raise the lettering on both sides of the card, as shown in the illustrations at the left. Intricate technical difficulties have heretofore made the pressure casting of such a thin product impractical.

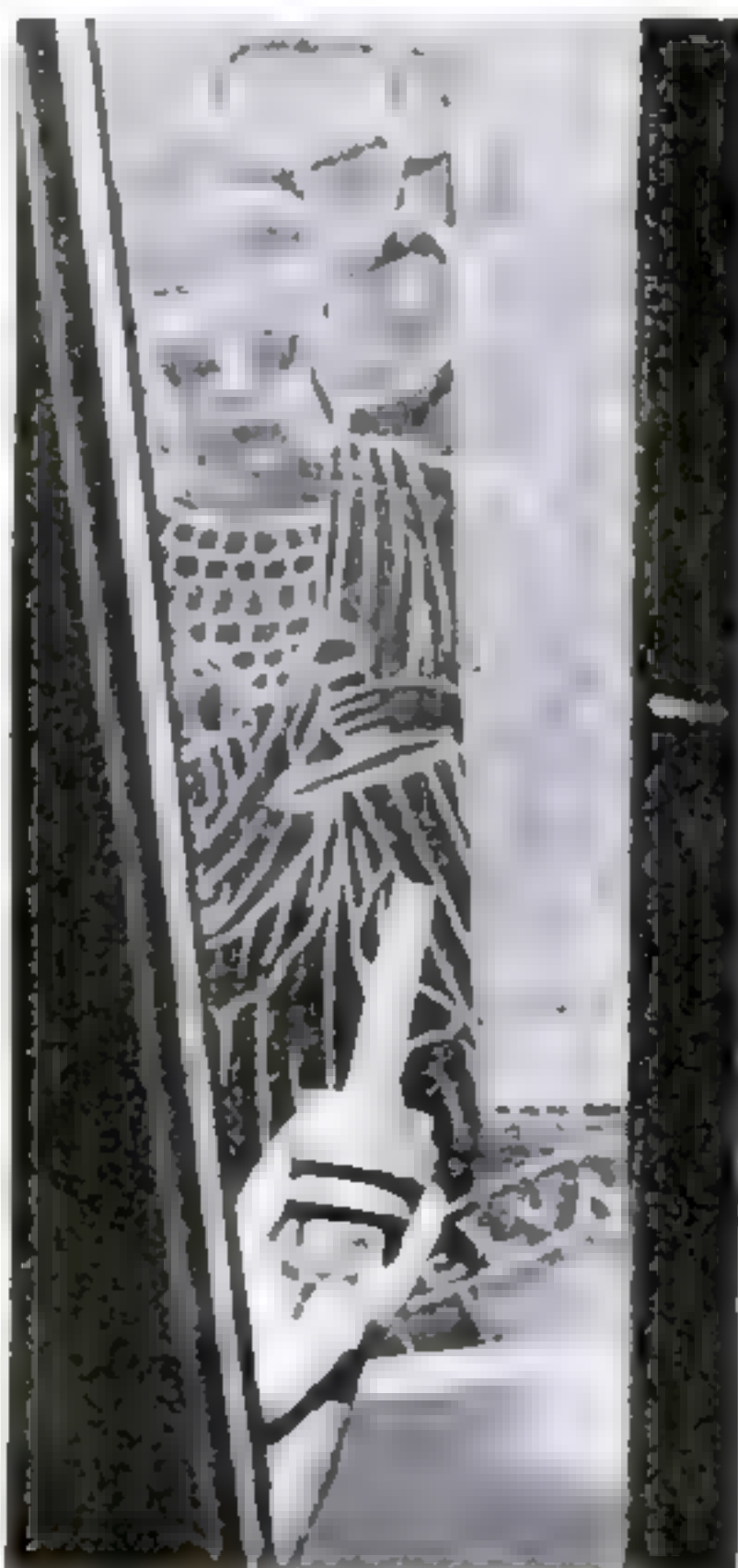
One-Piece Stained Glass Windows

CREATED BY NEW METHOD

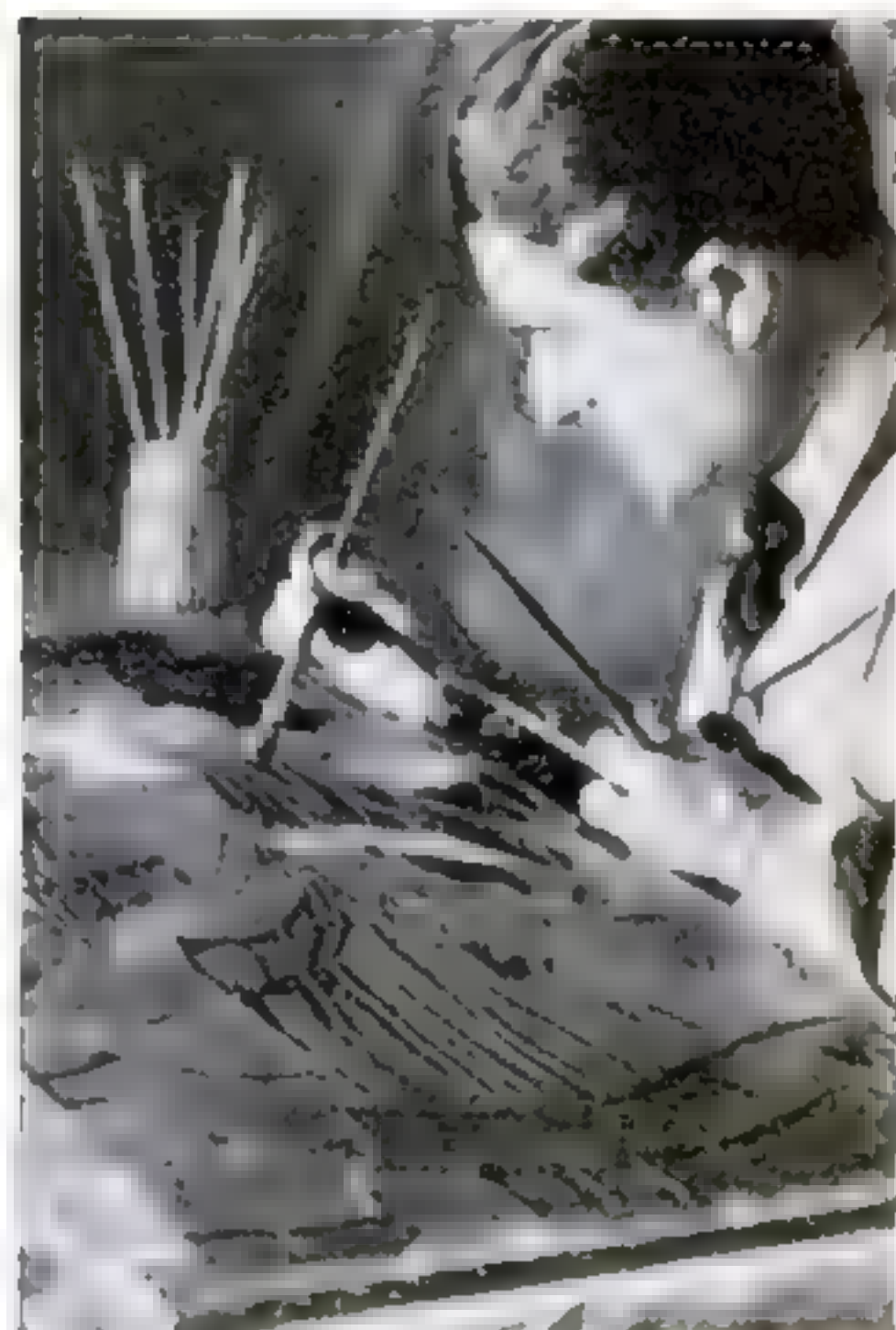
STAINED-GLASS windows for use in churches, homes, and other buildings, are now made all in one piece by a novel sand-blasting technique developed recently by a New York City artist. The new product, its maker claims, is not only less expensive but stronger than the conventional leaded windows, which are made in many different pieces and are said to be susceptible to changing weather conditions. In the new one-piece method, a single sheet of unbreakable, fire-retarding glass is first



1 A single sheet of glass is covered with masking tape, on which the design is traced and cut out



2 Exposed parts of the design are then sand-blasted, as seen on left side above



3 After the remaining outline of protective tape has been removed, an artist applies color as desired



4 The finished window. Coloring material is a special varnish that bakes itself on the glass more firmly in the sunlight

completely covered with masking tape on which the desired picture or design is traced and cut out with a stencil knife. Exposed parts of the design are then sand-blasted. Next, the remaining protective tape is removed and the glass thoroughly cleaned with clear water to remove all trace of sand dust. Artists then apply the colors to the blasted areas, leaving the raised, unblasted lines to give the effect of the usual lead strips. The paint used is a special varnish which bakes itself into the glass by exposure to the sun's rays after the window has been set in place. The use of glass that is reinforced with wire is said to give windows of great strength, even when applied to large areas, eliminating the usual danger of breakage by wind. Various steps in the process are pictured on this page.



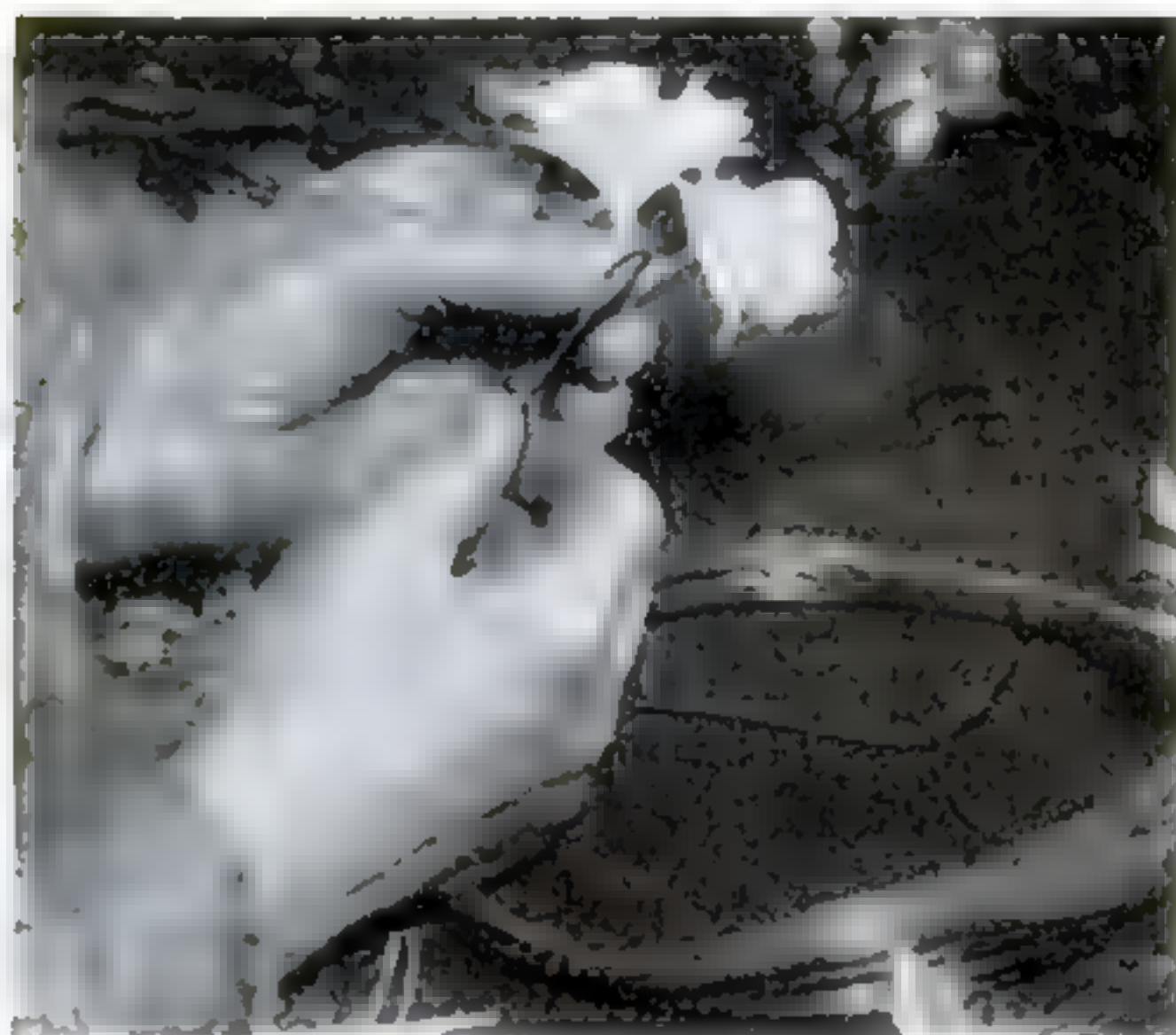
Fred Groesbeck at work in his chicken-coop shop making feather flowers



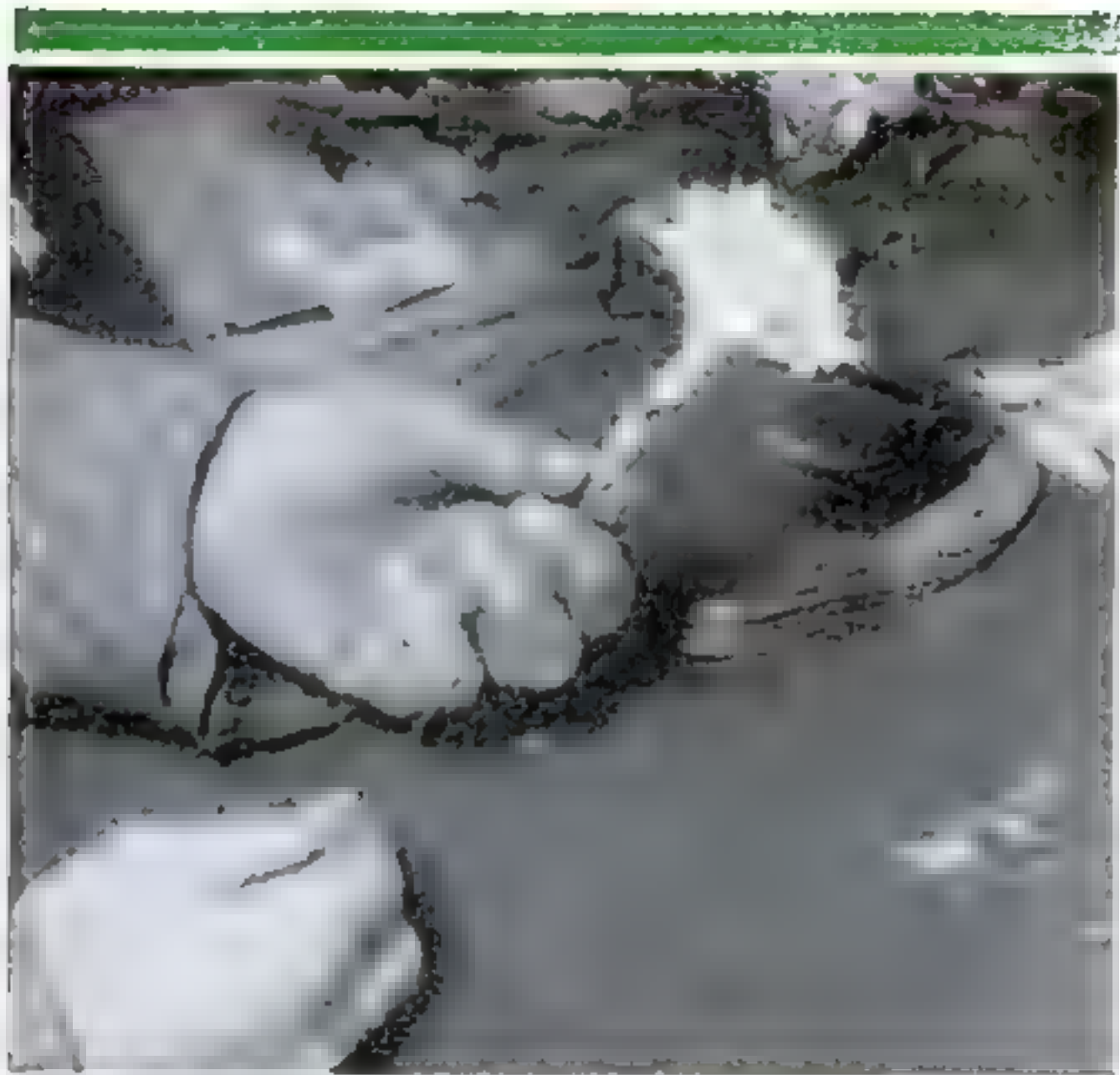
1 In making an imitation carnation, ends of feathers are first clipped off and the fuzz is stripped from the lower shafts

THE most astonishing chicken coop in America is located beside a small stream near Vernon, in central Connecticut. Here, seventy-nine-year-old Fred Groesbeck works at a wide table turning out amazingly beautiful roses and tulips, carnations and lilies, violets and gardenias, all created from chicken feathers!

So realistic are these feather flowers that they have been sold from coast to coast as boutonnieres and corsages, as party favors, for decorating banquet halls and churches, for use in hospitals and at cemeteries, and for dressing up advertising displays. Groesbeck—who, incidentally, was the first man in the world to advertise live baby chicks for sale—has been called as far away as Pennsylvania and Ohio to



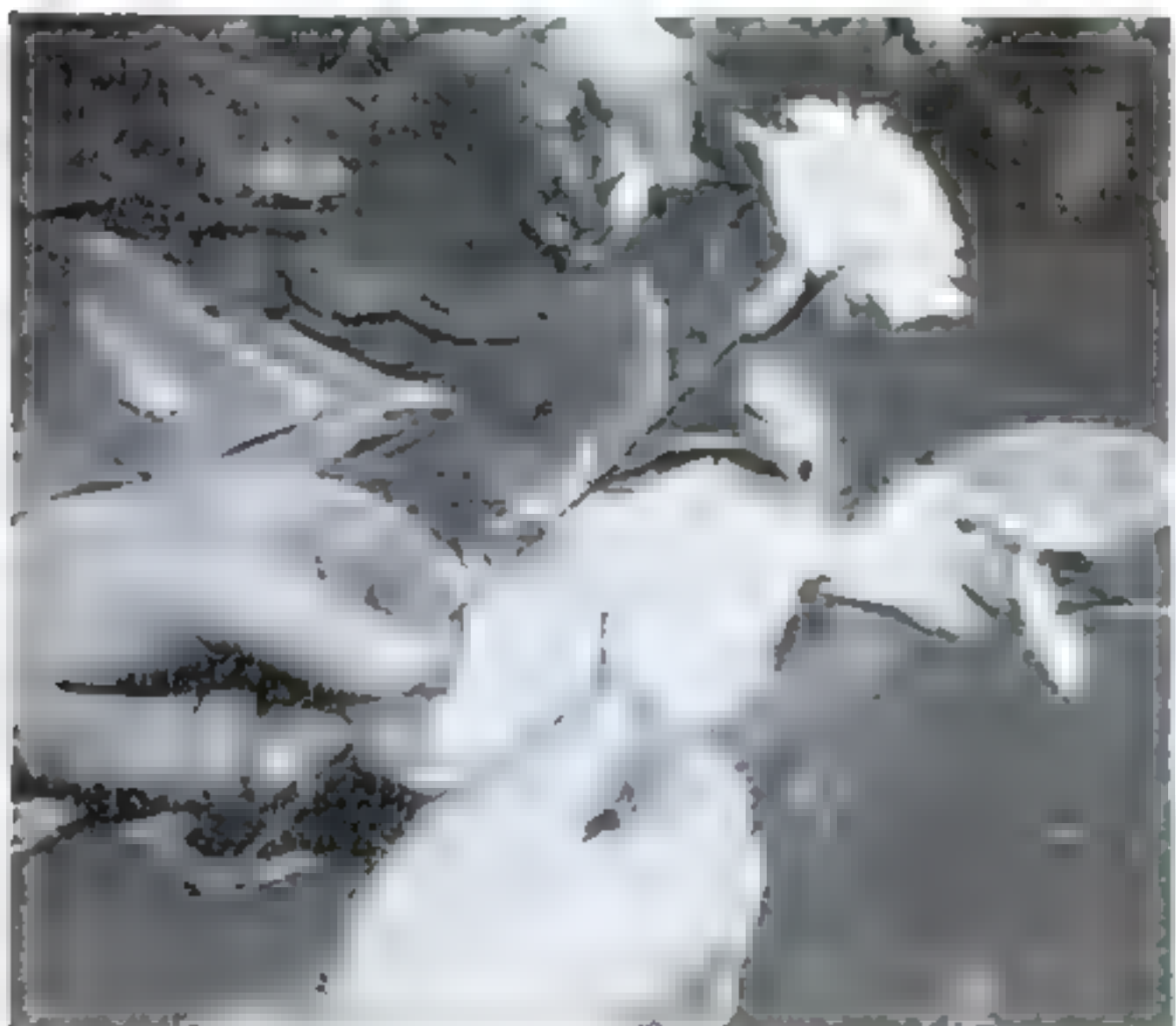
2 Two bunches of about thirty feathers each, bound with fine wire, are lashed to a heavier wire that serves as the stem



3 Groesbeck now slips a nipplelike sheath, or calyx, of green rubber up the wire to cover the base of the synthetic blossom



4 To represent leaves, two narrow feathers are dyed green and tied in place on the imitation stem with very fine wire



5 When the "leaves" are in place, the stem is ready to be wound from end to end with green tissue paper, which is glued

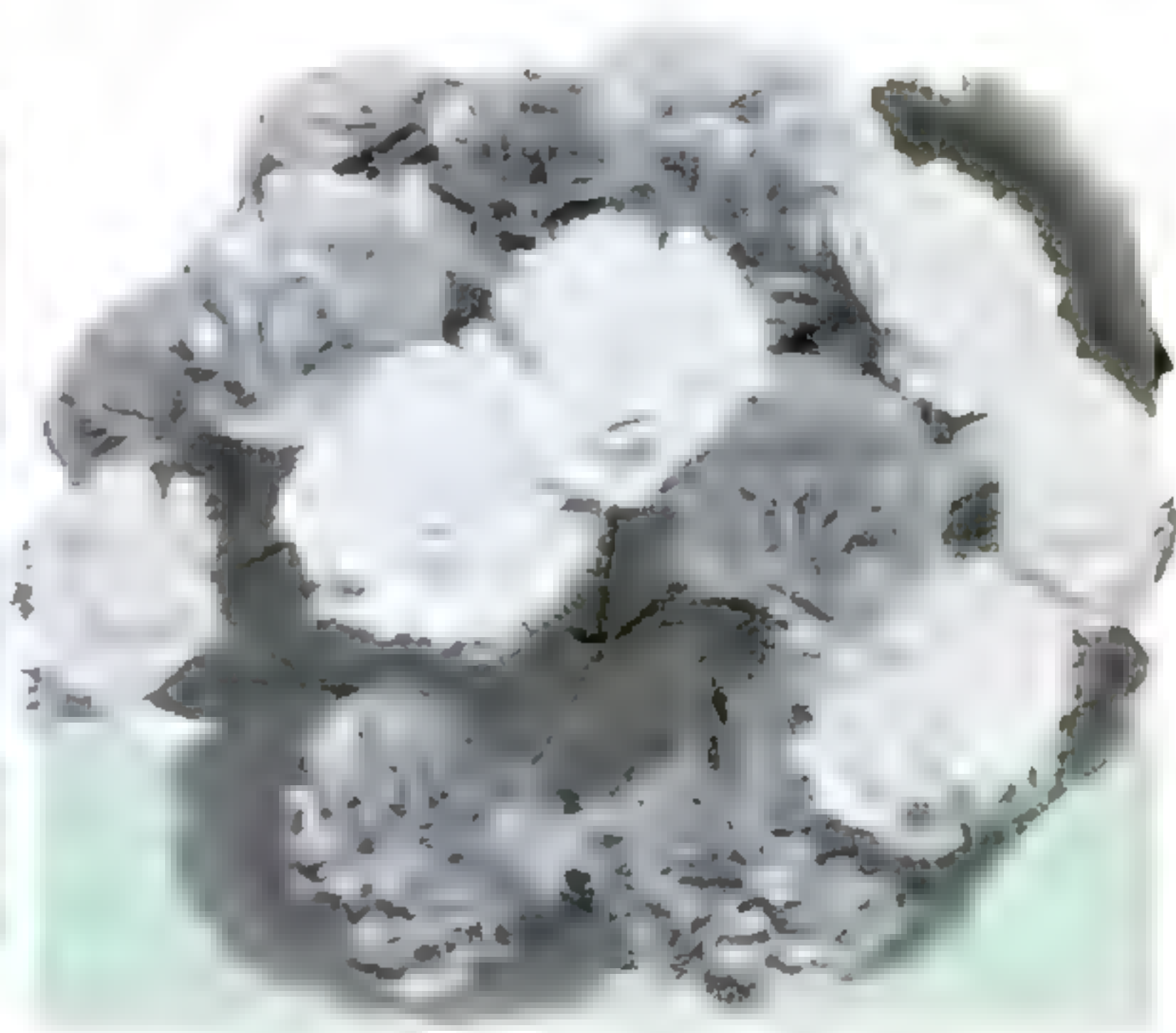
Flowers Grow on Hens' Backs for Fred Groesbeck, Who Can Turn Chicken Feathers into Lifelike Artificial Blossoms

By
H. C. DAVIS

arrange special displays of his products, and at one recent poultry show he sold \$1,500 worth of the chicken-yard blooms. Gardenias, the petals of which once grew on the back of a Connecticut hen, were worn by an American visitor at the coronation of King George VI in London last year.

Groesbeck's unique business is still his hobby. It began almost half a century ago when he was employed in a greenhouse at Hartford, Conn. As a small boy he had lived on his grandfather's poultry farm, and one day as he looked at waving carnations in the greenhouse, they reminded him of the tails of hens at feeding time. He began to wonder if he couldn't make artificial carnations from feathers. When he tried, he was surprised at his success. A local milliner saw some of his imitation blooms and bought them as a novelty for use in trimming hats. That started Groesbeck on his way to fame as a flower maker. During the intervening decades, while he has been building up one of the leading poultry farms of New England, he has added many new creations to his list as a spare-time hobby.

That list now includes five kinds of roses, four



6 Finished feather carnations. The flowers are colored realistically with permanent dyes



when the artificial blooms have been on exhibition at fairs and poultry shows, honeybees have been seen alighting on the feather petals and crawling about in search of nectar.

In making his flowers, Groesbeck uses only two tools, a pair of tweezers and a pair of scissors. With the latter, he snips off the tips of a feather. Then he strips away the fuzz at the base of the quill, and the feather is ready for use. Making a carnation requires half a dozen steps, which are illustrated in these pages, and the whole operation takes Groesbeck from fifteen minutes to half an hour. Some of the more elaborate feather blooms involve even more work, and require several hours to make.

kinds of carnations, two kinds of tulips, four kinds of lilies, besides gardenias, camellias, hollyhocks, pansies, fuchsias, violets, sweet peas, buttercups, daisies, and poppies. The prices range from twenty-five cents apiece for daisies and violets, to \$1.50 apiece for water lilies and roses of the largest size. All told, Groesbeck has sold upwards of 100,000 of his unique barn-yard blooms.

Before being used, the feathers are washed, ironed, sterilized, and mothproofed. Sometimes, half a bushel will be sorted over to get the right selection to make a flower. A carnation requires approximately sixty small feathers, while a large rose may demand more than 100. Morning glories are formed of thirty selected feathers. Tulips require only sixteen. The smallest number of feather "petals" go into the making of violets and daisies. The former uses only five, the second, nine. Gardenias, although relatively small, require fifty feathers, carefully selected for size and shape. One small feather out of place will spoil a whole flower.

The best seller on the list is the carnation. Next comes the rose. Both are supplied in a number of shades and, if the customer wishes, are given a touch of perfume to heighten the effect. Many times,

When the flowers are colored—and more than twenty shades are employed in tinting the blooms—the feathers are treated with waterproof dyes before they are bound in place. These dyes are so permanent that it is said the flowers can be left outdoors in rain and sunshine for weeks at a time without altering their hue. If the flowers become dusty or dirty, they can be washed in benzine, gasoline, or soapsuds.

Many of Groesbeck's blooms which were



More creations of the barn-yard florist. A large rose like that in the center may take as many as 100 feathers

sold a dozen or more years ago are still in good condition. One large sewing-machine concern, for instance, is dressing up advertising displays with artificial flowers purchased from the Connecticut farm fifteen years ago. The permanence of Groesbeck's product has another aspect. Physicians have reported a psychological benefit in having flowers that do not wilt and die in the rooms of convalescent patients. By making such enduring blooms, Groesbeck has found happiness for half a century. His curious hobby brings pleasure to others as well as himself.

Oftentimes, purchasers of the artificial blooms put them to curious uses. One customer on Long Island, not long ago, ordered a dozen pond lilies attached to corks. He was having a garden party on his estate and wanted to give his lily pond the appearance of blooming out of season. Each year, another customer in New Jersey gets out his feather tulips as soon as the first green leaves appear above the soil in spring. By sticking these gayly colored blooms in the ground, he creates an attractive display long before his neighbors' plants have even budded. And a jeweler in New York City buys the smallest carnations Groesbeck makes—not to wear, but for dusting out fine watches!



A group of smaller flowers. It is difficult to believe that these petals come from hens' backs

Tests for Balance O.K. High Heels

A METAL pencil has just written upon smoked paper a vindication of high-heeled shoes for women. Testing their effect upon body balance, Dr. Walter Mendenhall, of Boston, finds that girls wearing the much-maligned footgear can often stand more steadily than barefoot subjects. The telltale pencil, attached by a headband, recorded a subject's wavering upon a chart.



How scratches on a smoked-paper chart show a subject's balance in the test with high and low-heeled shoes pictured at the left

The World's First Highway Center Line?



This Mexican road was built 400 years ago—with a white center line

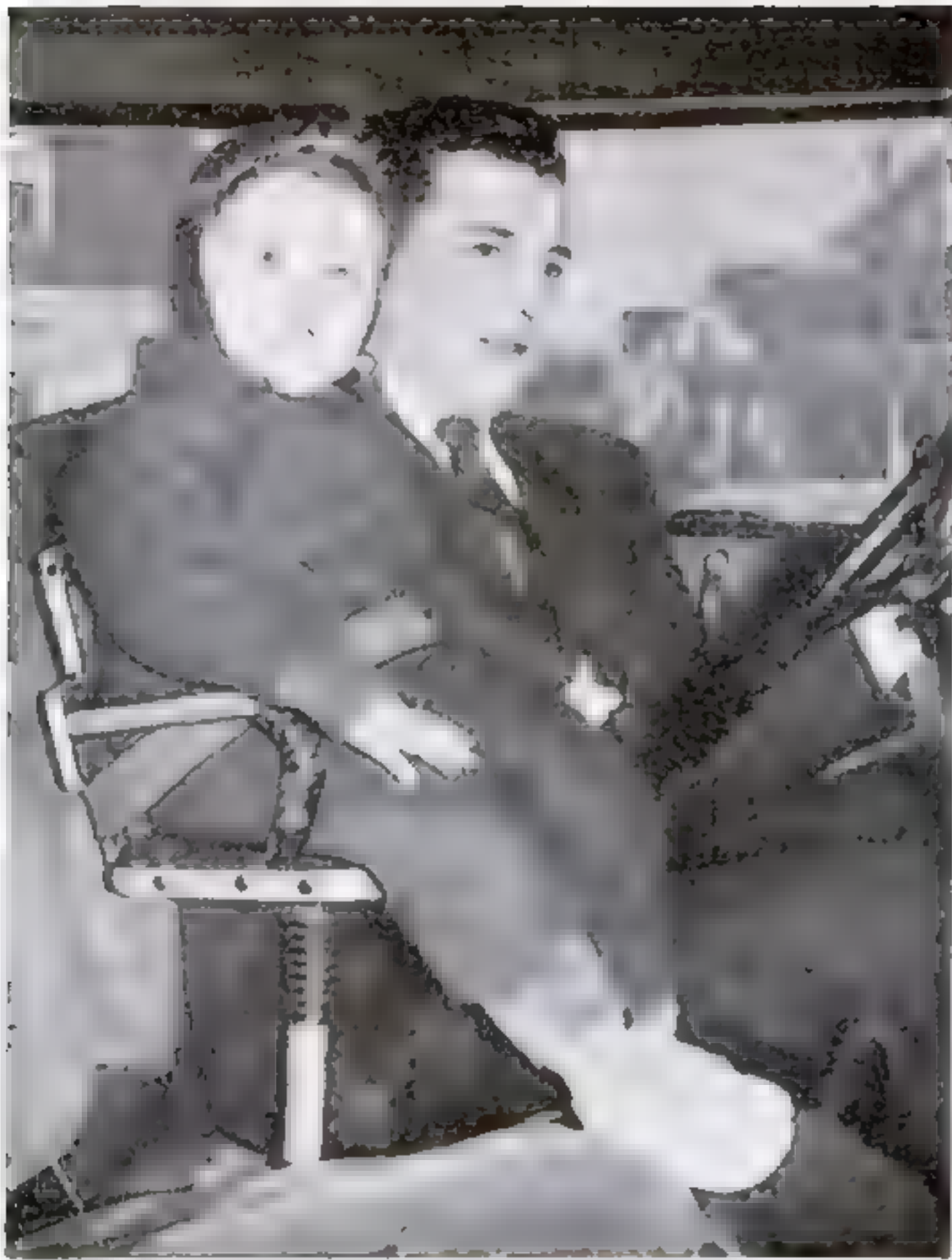
WHO invented the safety center line for highways—and when? After a nation-wide search for the originator, some time ago, a leading tire firm awarded a plaque to the late Edward N. Hines, traffic-safety expert of Detroit, Mich., for introducing the idea in 1911. Newer evidence shows that, while he may have led the way to its world-wide use for modern motor roads, some one else thought of it at least 350 or 400 years ago! The accompanying photograph of an old Spanish stone highway, constructed in that era between Mexico City and Cuernavaca, Mexico, plainly shows a built-in center stripe of lighter-colored stones. Its purpose remains a mystery, but perhaps it served to prevent arguments between "road hogs" in the days of travel by burros and wagons.

Compressed Air Powers Saw for Tree Cutting

OPERATED by compressed air, a new power-driven crosscut saw enables two lumbermen to do the ordinary work of six, according to the maker. A pair of adjustable guides hold the tool in place for cutting logs of any size up to four feet in diameter. One operator handles the controls at the piston end of the saw, while the other manipulates the blade with the aid of a safety guard that protects him from its teeth. If the blade jams, it is easily detached from the driving mechanism. Compressed air for the saw is supplied by a portable compressor mounted on a tractor.



Designed for cutting down trees, as in upper photograph, or cutting up their trunks, the compressed-air-driven saw lets two lumbermen do the work of six



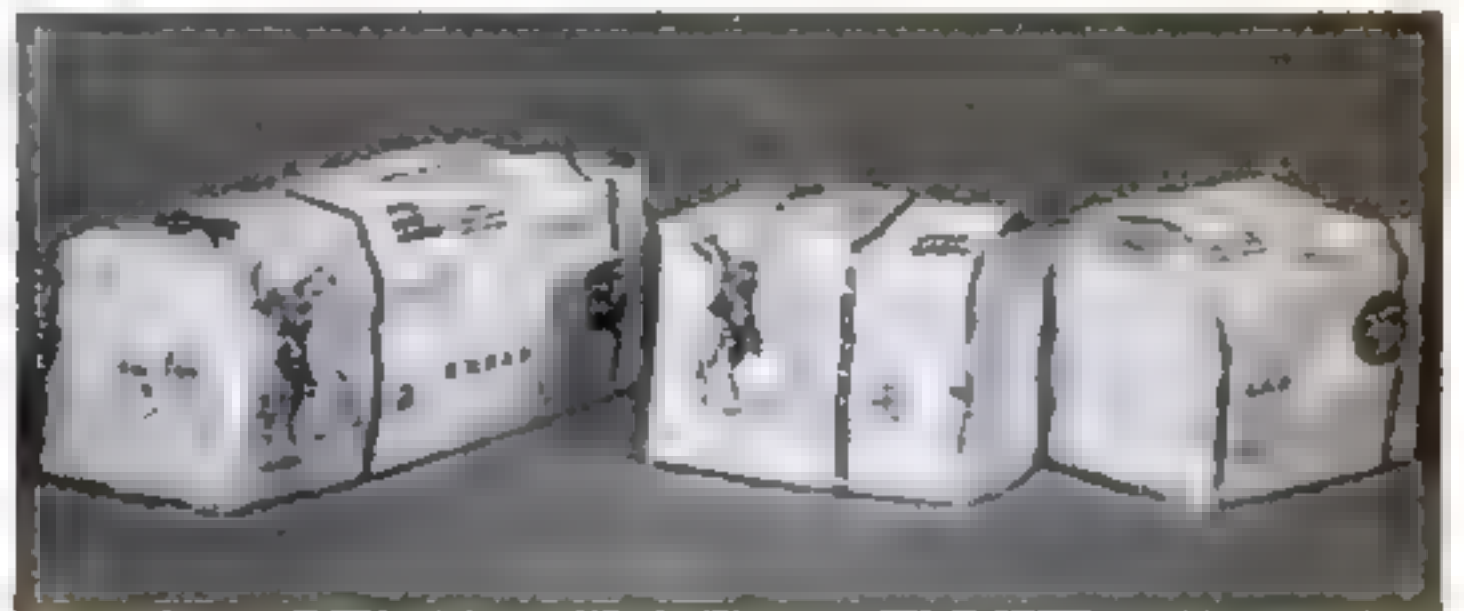
Chair rests on a column fastened to the car floor

Baby Goes for Car Rides in Homemade Armchair

NO CONVENTIONAL sling-type infant's chair for automobile use would satisfy the baby son of Lester Bresson, of Torrington, Conn., so Father constructed the armchair shown at the left. Made from odd bits of wood, strap iron, and discarded upholstery fabric, the chair rests on a column extending to the floor between the car's two front seats.

Bread Wrapped by Half Loaf

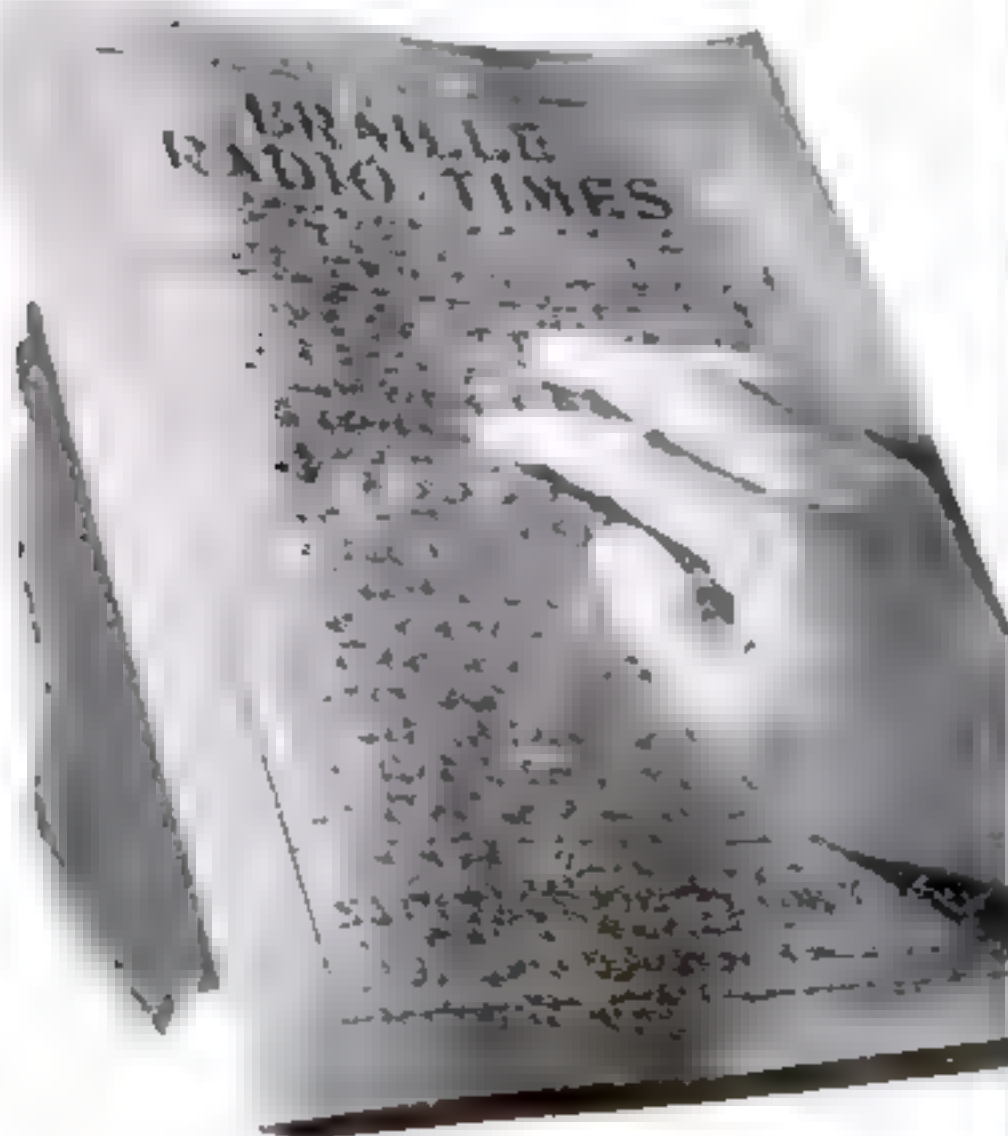
TO KEEP bread fresh, half loaves are now being wrapped separately in waxed paper. While one half is being used, the other remains protected by its wrapping until needed.



Radio Schedules Printed for the Blind

PRINTED in raised Braille characters, weekly schedules of radio programs are now being furnished to blind radio owners in England. Part of a philanthropic movement to provide radios for all the 72,000 blind persons in Great Britain, the schedules enable sightless listeners to select their favorite programs instead of being

forced to rely on others for help. Constructed especially for blind operators, with knobs and dialing apparatus simplified for their use, over 44,000 sets have already been distributed. The receivers are exempt from the license tax.



Sensitive fingers search for a favorite program. Right, a sightless couple enjoying their radio



Beach Guards Save

Los Angeles, Calif., life guards with the hollow mahogany paddle boards they use in rescue work



Lives with Surfboards

By JOHN E. LODGE

THROUGH his powerful telescope atop the guard house at Venice, Calif., Myron Cox observed the figure of a young woman swimming slowly in the breakers. "Feet down, elbows out," he muttered. "Better get that baby."

Captain Cox, chief of the life guards who protect 10,000,000 bathers along the ocean beaches of Los Angeles, Calif., every year, raced down the stairs and grabbed up a hollow paddle board.

Grasping the board midway along one side and holding it under his right arm, he gripped the upper edge with his left hand to prevent it from swinging. With the board in this position, he ran into the water. Reaching ankle depth, the guard suddenly crouched, dropped the board forward and flat on the water. Without checking his momentum, Cox flung himself on the board. Supporting himself by one foot and both hands, he adjusted his balance, sank to a prone position, and started paddling. Three times faster than he can swim, the captain plowed through the waves and on over quiet water to the tiring swimmer.

Laying his course a few inches to one side, he rode by without slackening speed, grasped the girl's arm, and as the board stopped moved to a sitting position, well back of center. Quickly he grasped her arms, pulling them across the board until her chest touched the edge.

"Breathe deeply," he instructed. "Relax."

When she had regained her wits and breath, Cox seized the back of her bathing suit, slid her inch by inch onto the board until she lay

SURFBOARD TO THE RESCUE! Capt. Myron Cox demonstrates the technique of a surfboard life-saving job, from the time an exhausted swimmer is sighted from a tower until she is brought safely to the shore



RADIO BEACH PATROL. Two-way communication between guard headquarters and the offshore boat "El Salvador" speeds help to swimmers in trouble



Guards spot an exhausted bather through a telescope. In circle, a call reaches the crew of "El Salvador" from the headquarters office seen at far right and the speedy craft dashes alongshore to assist the guard from the beach



at full length, face down. Then he reclined back of the victim, and, with powerful overhand strokes, paddled ashore. When they reached shallow water, he slid off and gently lifted the girl to dry sand.

"Three seconds may spell the difference between life and death in a rescue," Cox will tell you. But paddle boards and a host of other aids including two-way radio communication with fast motor boats, special life-saving belts, chutes for launching the boards at pier ends, and beach patrol cars carrying inhalators and other first-aid equipment are helping guards to reach exhausted swimmers in time.

Treacherous rip tides, strong outgoing currents centering at one point, necessitate a fourth of all rescues among bathers at southern California beaches. Small-boat disasters, physical exhaustion, cramps, nonswimmers wading in over their depth, strong swimmers trapped by strong tides require immediate

aid. When tragedy threatens beyond the breakers, the guards swing into action, converging on a victim from both land and sea.

Not long ago, two swimmers were seen to be laboring in heavy swells off Venice. Guard Floyd Hagan, in the tower at Avenue 30, lifted his telephone from the hook, grabbed a life belt, and raced into the surf. At headquarters, several blocks distant, John Dillon caught the flash on the switchboard. When Hagan failed to answer, Dillon shouted to his aides, "Hagan's in the water. Start the truck." Turning back to the radio, he spoke these words quickly: "Station WXYL calling WXYK. Go to Avenue 30. A Rescue."

Through a porthole in the tower room, Dillon saw the crew of *El Salvador*, the rescue vessel, start the engine, cast off the lines, and swing the boat out. Meanwhile, as the little boat slithered at automobile speed through the sandbusters, Hagan reached the

swimmers. Around the weaker, he snapped the rubber life belt. Supporting one and towing the other, he swam directly toward the boat. Ninety seconds after first noticing their weakening strokes, the guards had both men safely aboard and were roaring back to the pier.

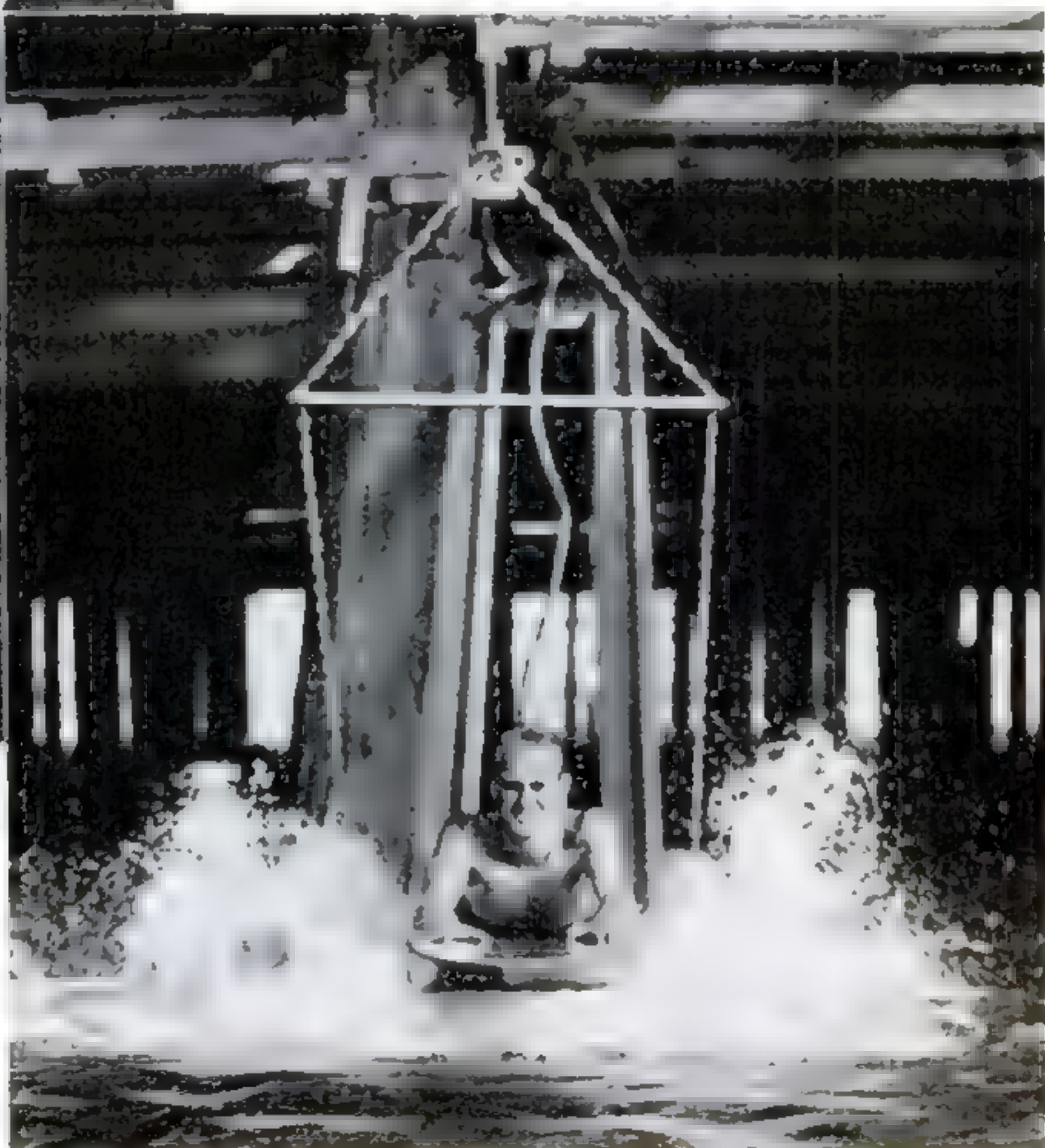
Occasionally, an unfortunate swimmer goes down the proverbial third time before a guard reaches him. But the guard is prepared to dive underneath and catch the victim on the way up. In cases requiring prolonged diving, the life-saving specialists wear single-pane goggles covering both eyes. These increase their range of vision under water.

All tricks, both mechanical and physical, are pointed toward greater speed in reaching those in need of help. Preston Peterson, champion paddle-boarder, recently designed a "peer-a-scope" through which guards look directly into the water. Through a magnifying glass at the bottom, Santa Monica guards can identify objects eighteen feet below the surface. Thus they locate drowning persons who have gone down for the last time.

Guards take nothing for granted when starting a rescue. If a swimmer appears to be weak, or should a crowd gather on the beach, away they go. It may be a false alarm this time, but the next trip may save a life. Alertness does save lives, too; not one accidental drowning occurred among the millions of bathers on Los Angeles beaches during the last year.



SHOOTING THE CHUTES. At Santa Monica, this surfboard chute gives the guard a flying start for a rescue. Set on the end of a pier, a greased slide shoots the paddle board out across the water, as seen at the right. In a recent test Preston Peterson, inventor of the chute, reached a "victim" 100 yards out twenty seconds after receiving the call



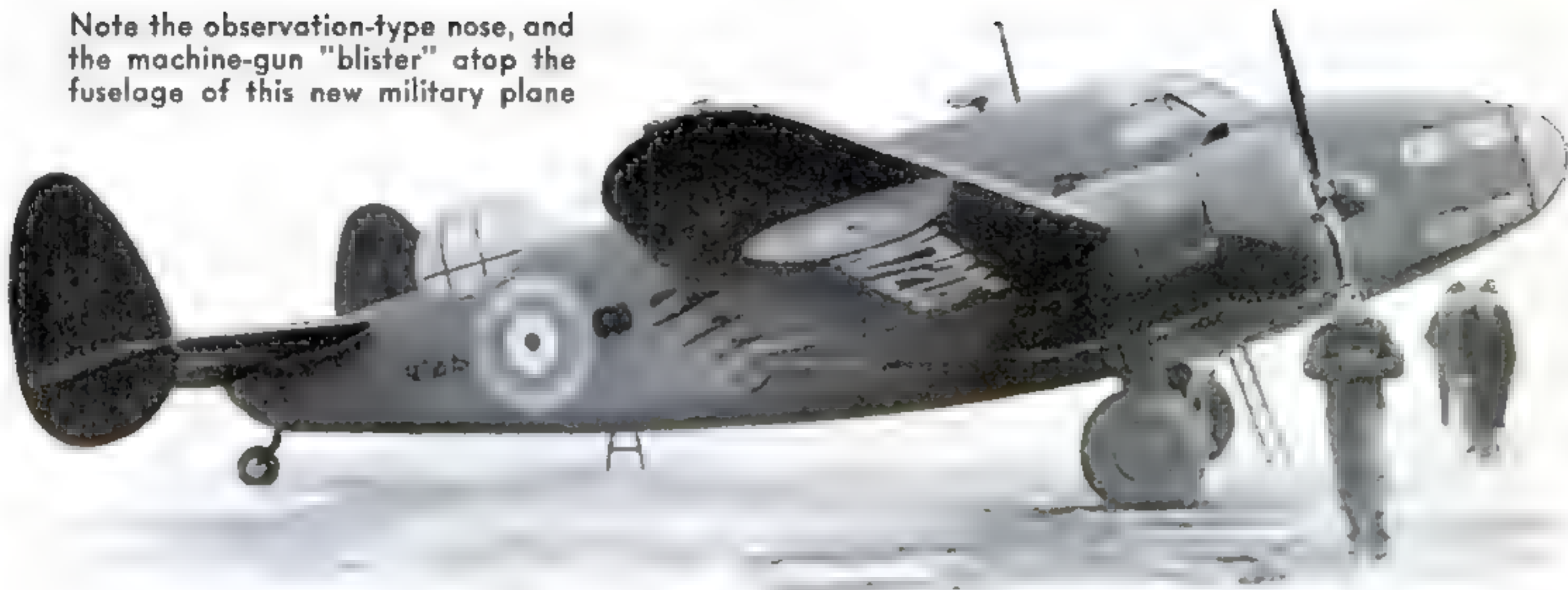
Movies Fill Gaps in Stage Play



WHEN you see stage and movie actors present the same play, you notice how much the stage action is limited by its few possible changes of scenery. To remove this handicap, a New York inventor proposes a combined stage-and-movie show, in which movies intermittently "double" for living actors. Suppose a leading character, in the flesh, strides from his house. Simultaneously, the lights dim, the stage darkens, a movie

screen moves horizontally across the stage, and a projector takes up the story of his travels and adventures. Meanwhile the stage setting is changed and the living actors take their positions in readiness for a new episode at the character's destination—say, an office. The movie ends as he arrives, the screen is drawn aside, the lights flash on, and the play continues. New dramatic possibilities are claimed for the plan.

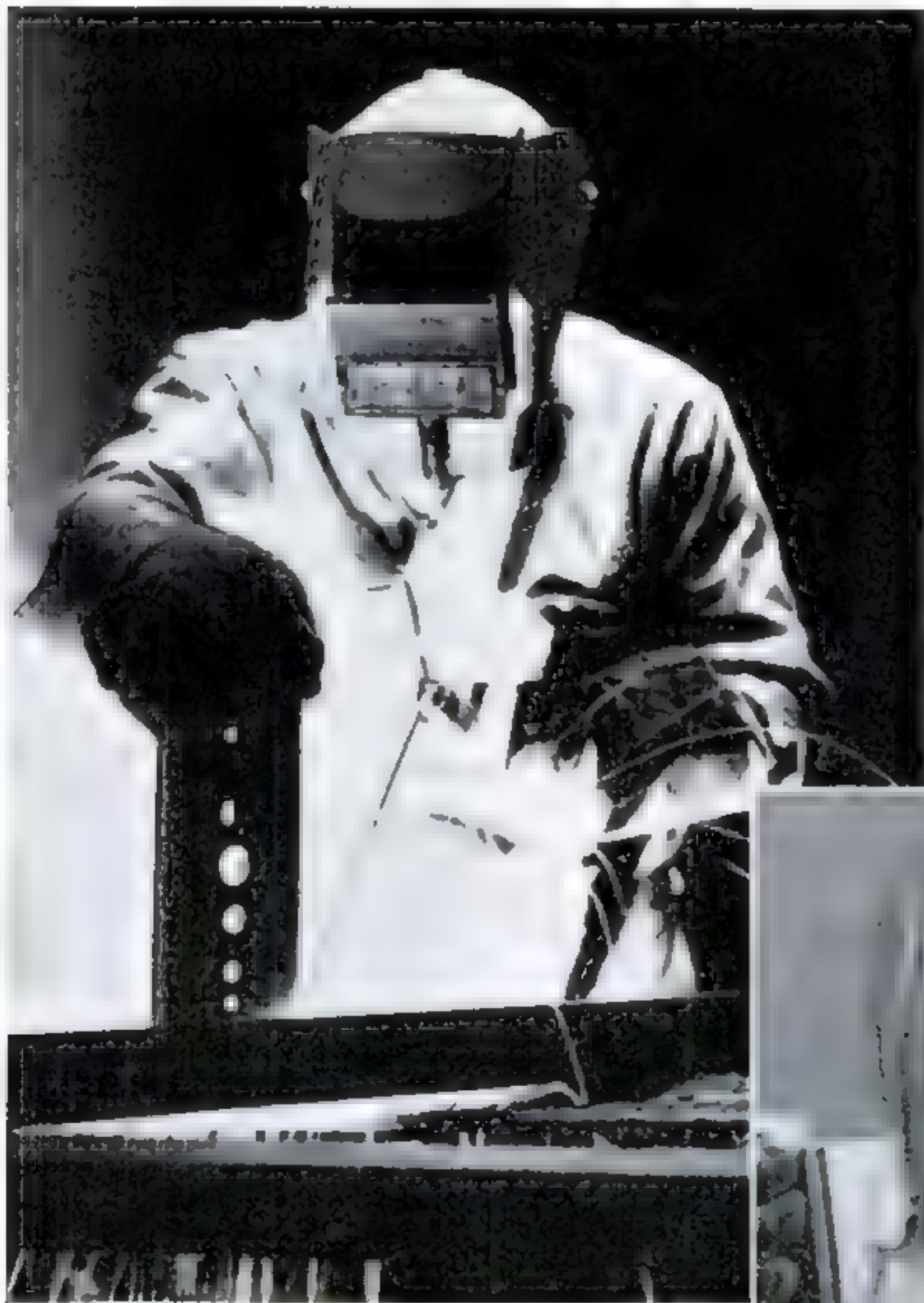
Note the observation-type nose, and the machine-gun "blister" atop the fuselage of this new military plane



Britain Buys Dual-Purpose War Planes

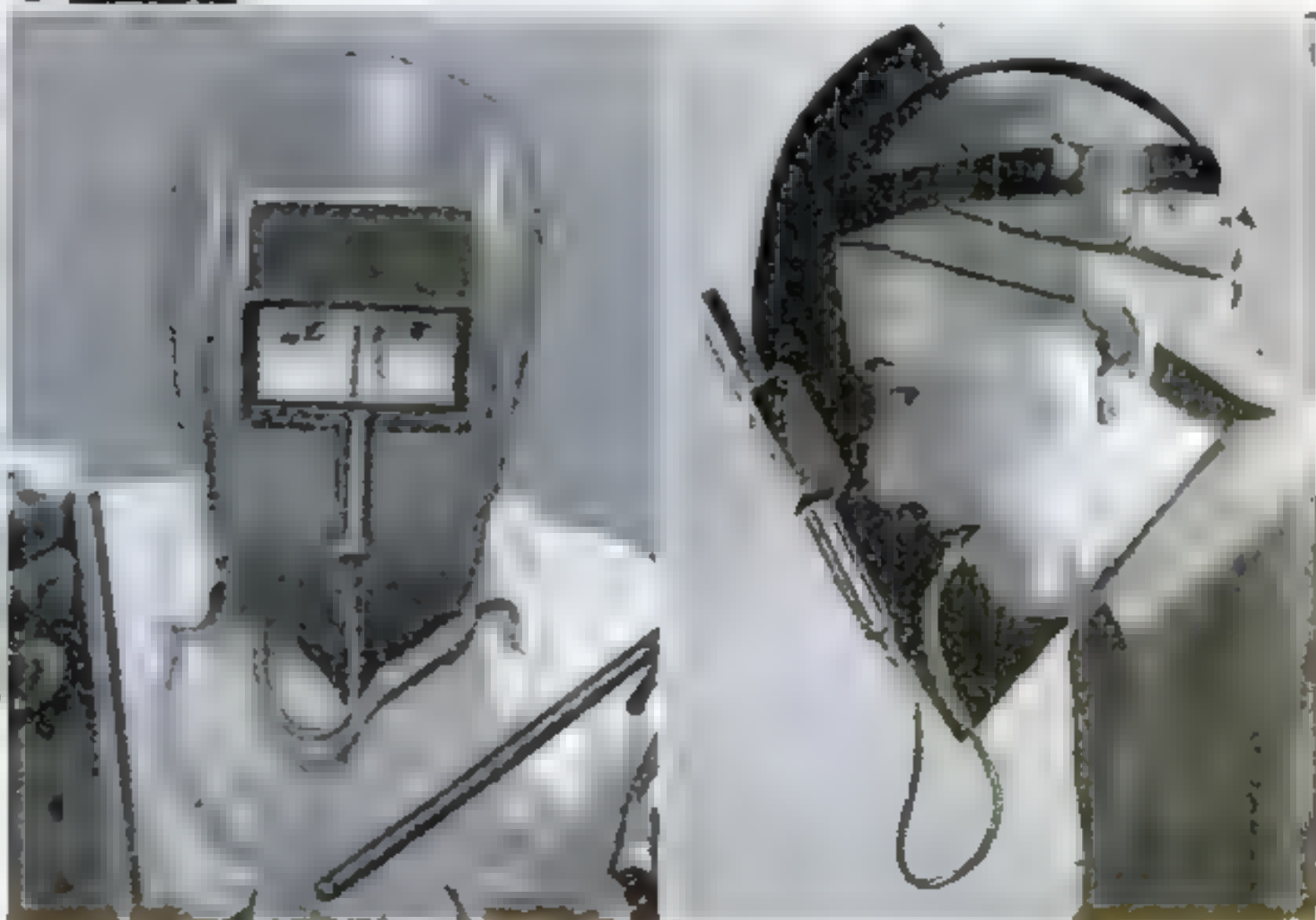
BASICALLY the same type of ship that was flown around the world last year in the record-breaking flight led by Howard Hughes, the twin-motor, twin-purpose plane shown above is one of 250 ordered in this country for shipment to England. Designed to serve

either as a fast observation plane or as a bomber, the ship is powered by two 1,100-horsepower engines that propel it at cruising speeds up to 250 miles an hour. A "blister" on the fuselage holds a machine gun, and the special nose can serve for sighting bombs.



Welding-Hood Window Raised by Lung Power

LUNG POWER raises or lowers a novel protective window recently developed for attachment to welders' hoods. To open the colored window lens when inspecting, cleaning, or chipping the work, a welder merely blows through a small tube held in his mouth, and the shatterproof lens pops up. Made of a plastic composition that is extremely light in weight, the window unit allows the workman free use of both hands at all times. To insure sanitation, extra tubes and mouthpieces are supplied so that a number of welders may use the same helmet successively.



The novel hood in use and, right, how it operates. Blowing into the tube opens the window, while leaving both hands free for work

Truck Is Equipped for Disaster Relief



Interior of the emergency car. It carries 1,200 pieces of rescue equipment, including a field-hospital tent

FIELD HOSPITAL, radio room, and power plant are combined in an all-purpose "disaster truck" just placed in service by the fire department of Portland, Ore., to rush to the scene of a fire, wreck, flood, or earthquake. Its 1,200 pieces of equipment include flood-lights, gas masks, portable radio sets, an outboard motor, hospital tent, surgical instruments, oxygen and anesthetic apparatus; a loudspeaker audible two miles away; a gun that fires a life line; and sleds and skis for rescuing injured skiers.

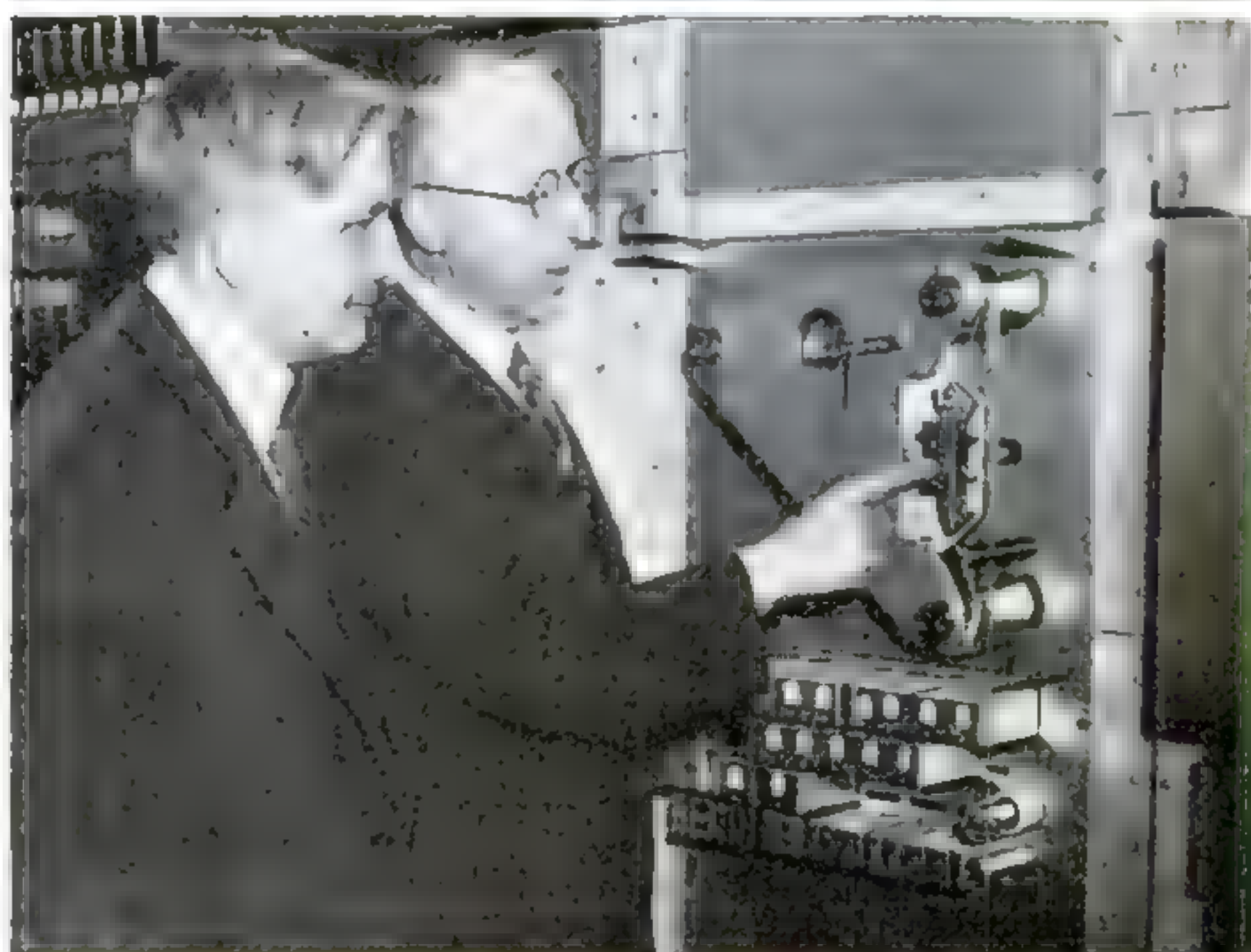


Through this microphone and a loud-speaker, intelligible speech can be thrown two miles to direct rescues

Testing the unit's lighting equipment. Carrying its own generators, it can light up a large area, or substitute for wired power

"Weather Man" Answers Calls from a Record

TELEPHONE users in New York City and vicinity who dial MERidian 6-1212 to get the exact time, can now call a new number, WEather 6-1212, to obtain the latest weather forecast. Four times daily, the local office of the U. S. Weather Bureau submits a forecast to the telephone office, where it is recorded on a continuous steel tape by means of a magnetic sound recorder. This recorded forecast is played back continuously so that the information is heard by anyone who calls the number. Each forecast requires about twenty-five seconds, after which there is a pause before it is repeated. Three machines will be operated, so that while one is out of service for recording, the others can carry the load. Automatic telephone equipment enables as many as 150 telephone users to "tune in" on one machine at the same time. As soon as a new weather report is received it is recorded and substituted for the old one in the reproducing machines. The service will relieve the Weather Bureau of much of the burden of answering calls.



One of the three automatic machines that tell New York telephone users whether it is going to rain tomorrow. You can see the magnetic recording tape. At top, a voice expert recording the forecast



Two-speed attachment replaces the regular pedal sprocket

Gearshift Attachment Fits Any Bicycle

FITTING all standard bicycles, a two-speed gear attachment now on the market makes hill climbing easier, low gear requiring only half the leg power. The unit is installed to replace the regular pedal sprocket, without disturbing the coaster brake. Gears may be shifted while the wheel is in motion, by means of a shift lever located near the handlebars and connected to the gear sprocket by means of a cable. Chromium-plated, the attachment is designed to withstand hard usage, and can be easily installed by the purchaser, according to the manufacturer.



Charles L. Smith exhibiting a rare "horseshoe" padlock from Germany

By WALTER E. BURTON

TO CHARLES L. SMITH, of Ashland, Ohio, a padlock is not just something you use in securing the garage door. Smith has been fascinated by locks ever since he was a boy and after tinkering with them for years and acquiring the skill of a master locksmith, he began twelve years ago to collect padlocks.

Today, his workshop, a tiny room in the rear of his home, is crammed with what he believes to be the largest collection of its kind in the world—about 500 different types of padlocks gathered from all over the United States and from thirteen foreign countries. His smallest item is a seventeen-grain lock made with the preci-

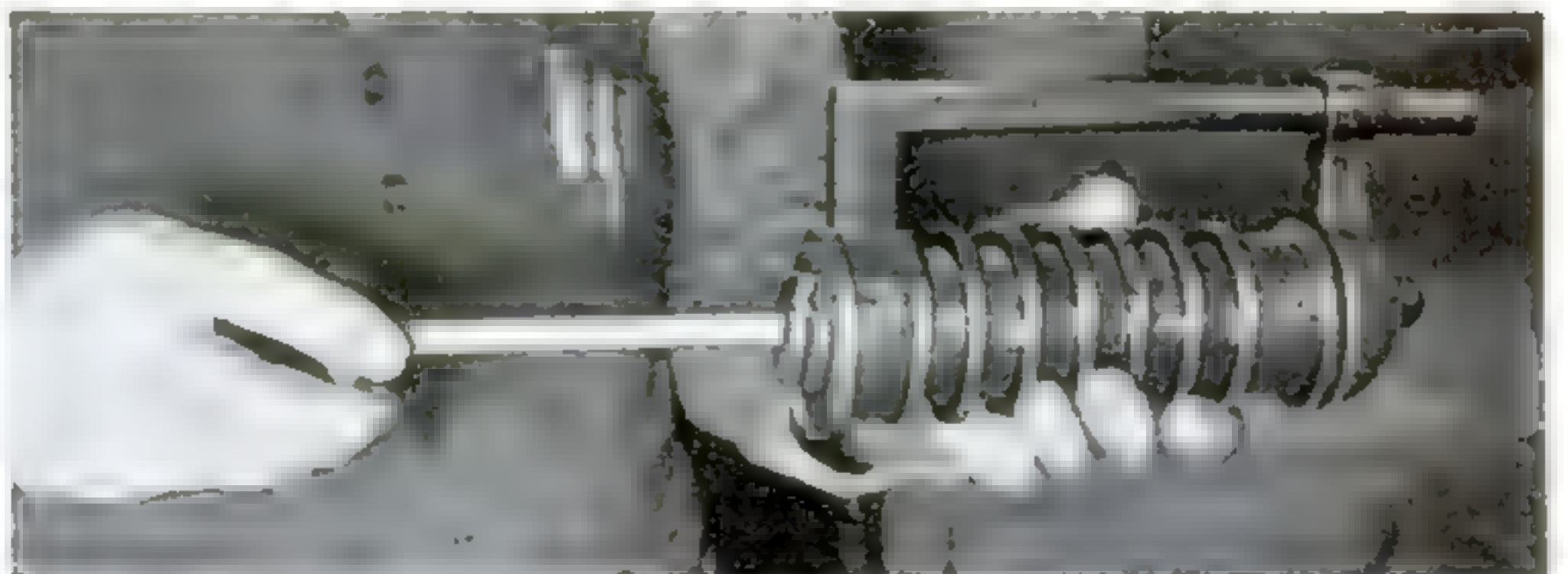
sion of a fine watch. At the other extreme is a 19½-pound, three-lever job that Smith himself built.

A good many of the locks have come as presents from people who have heard of Smith's hobby. Others, he obtains in trade. Still others are brought from foreign lands when friends return from trips abroad. One surgeon, stationed in India, sends him two or three Oriental locking devices each year. Every one of Smith's 500 items is in perfect working order. He cleans each lock, makes any new parts that are needed, and provides the mechanism with a key before he adds it to his collection.

In making the keys, he has developed exceptional skill. One curious lock from India required as a key a long metal rod with a series of vanes arranged around it like the threads on a screw. The lock, itself, is a massive cylinder of cast iron with a perfectly round keyhole at one end.

Another unusual item on his list is a curious combination lock designed for use by a workman at a fac-

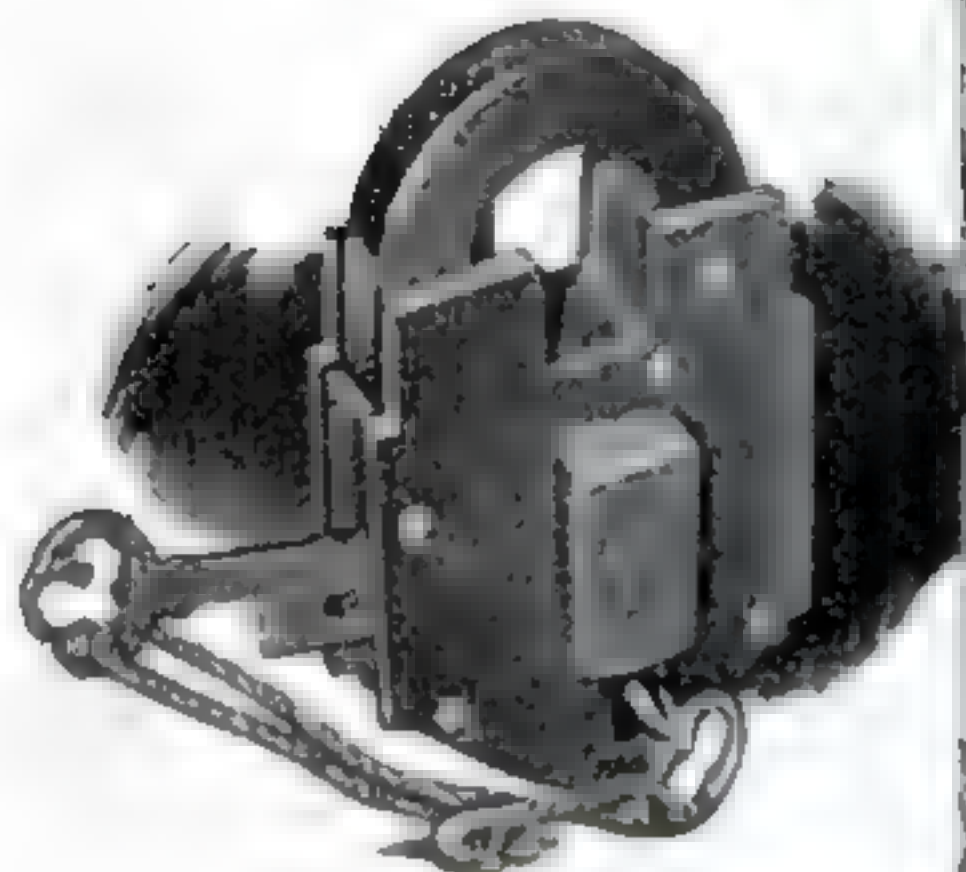
tory. Ordinary combination locks have the disadvantage that the user may forget the combination numbers. In this mechanism, if the original combination is forgotten, a key can be inserted and the lock will respond to a different combination, which is known only to an official of the factory. At the same



This curious specimen from India is opened by screwing in a boltlike key

Padlocks

FORM THE WORLD'S
LARGEST COLLECTION



Two keys are required to open an odd English-designed lock

time, when the key is turned, out pops a piece of metal bearing the numbers of the forgotten combination!

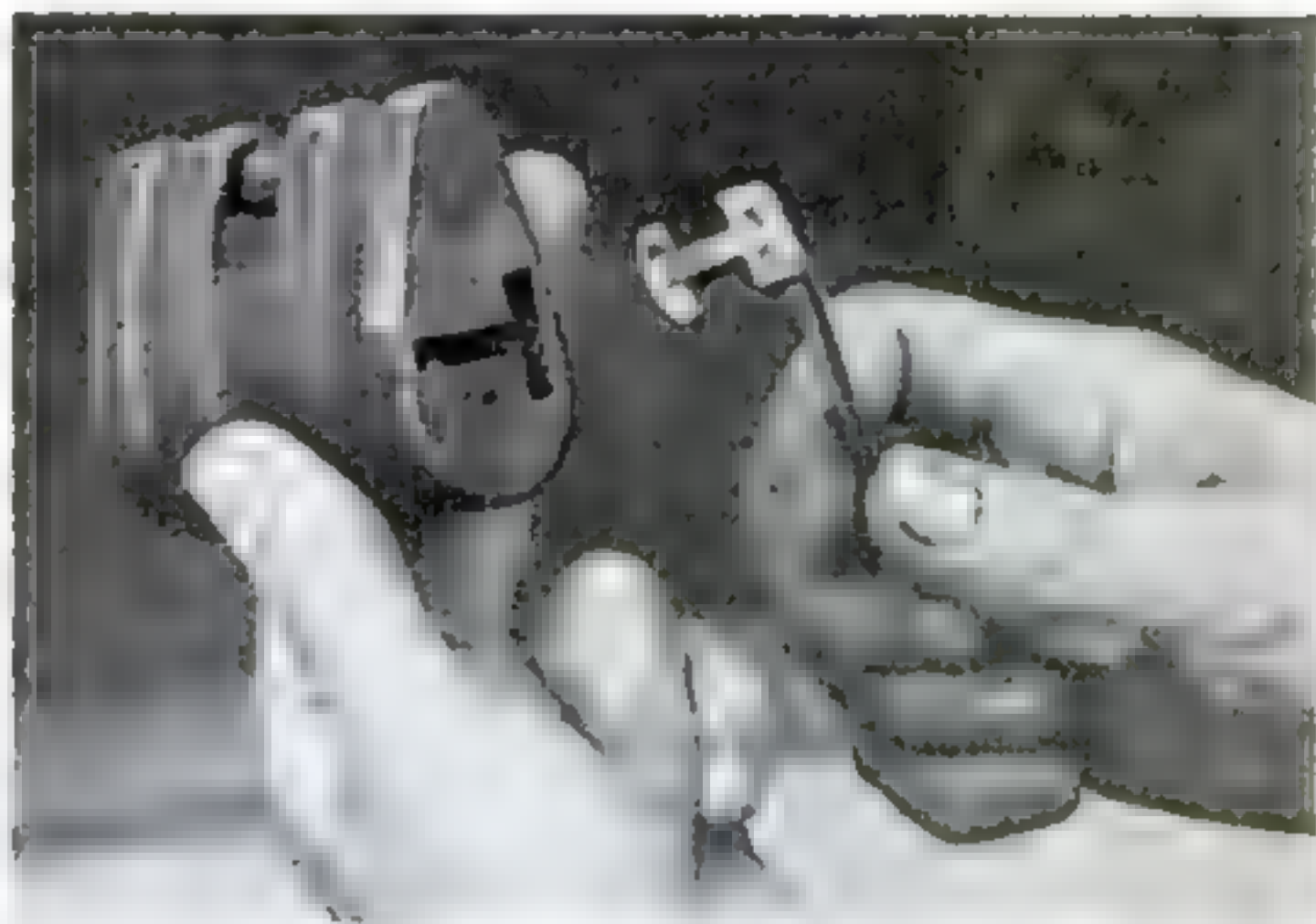
When Smith is not busy at his regular job as a machinist in an Ashland factory, he spends a good part of his spare time, including his lunch hours, making keys for friends, unlocking safes for which the combinations have been lost, and helping motorists who have locked their cars and left the keys inside. To help him



Here are a few of Smith's 500 padlocks, gathered from thirteen foreign countries as well as the United States. One weighs only seventeen grains



Biggest lock in the collection. Smith made it himself



A queer lock and key received from India. They were sent by a man who had heard of Smith's unusual hobby

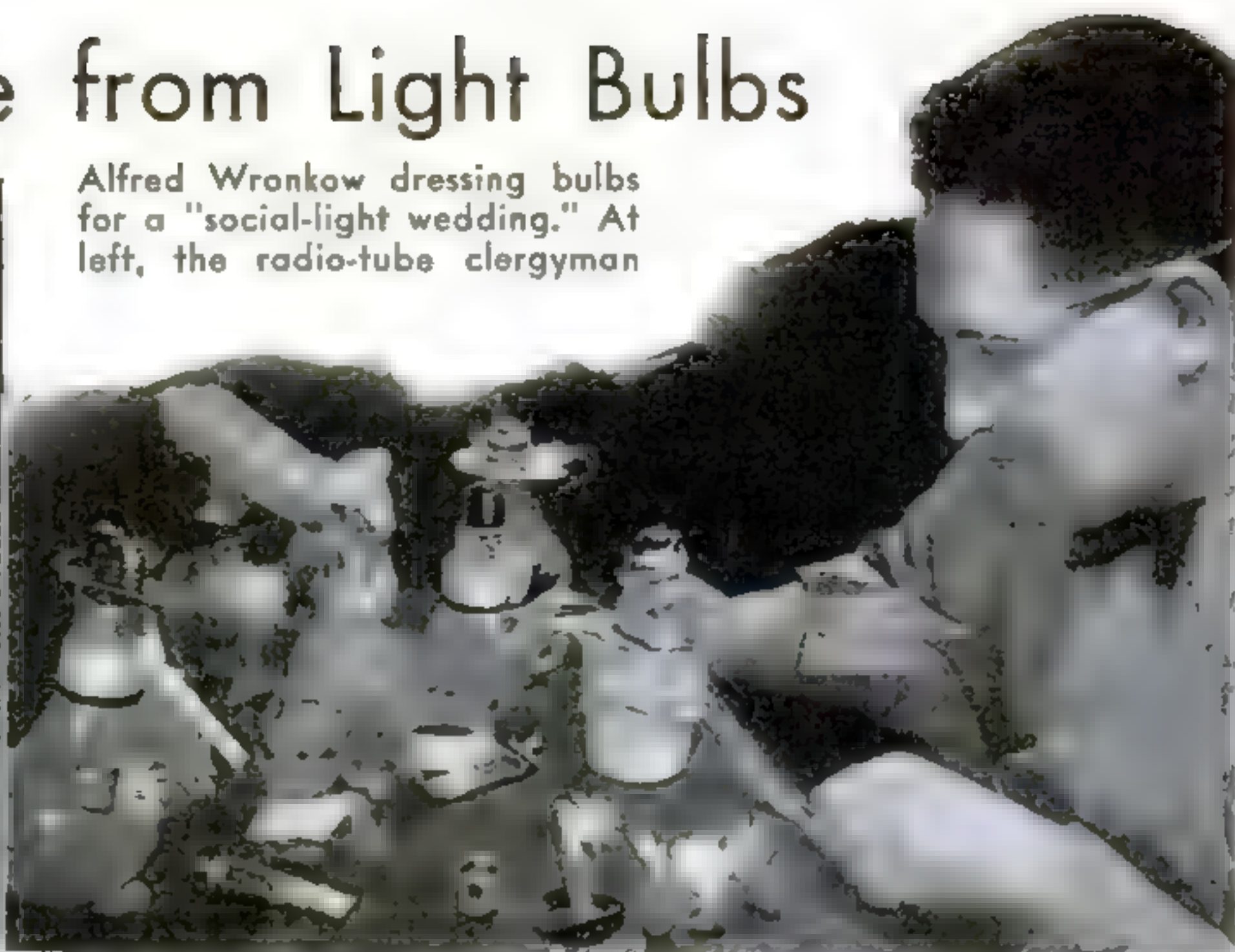
in such work, he has assembled an amazing array of curious tools. One aid is a small telescope rebuilt by his son for close work. With it, Smith can read the number on a key in the ignition lock through the window of a car. By referring to a complete file of automobile-key code books, he can then duplicate the key, avoiding the necessity of forcing the door.

Have you ever wondered why automobile keys are made of brass that seems soft and easy to bend or break? Smith says that the reason is that a harder metal like steel would wear the lock mechanism too rapidly; and keys are cheaper than locks.

Puppets Made from Light Bulbs



Alfred Wronkow dressing bulbs for a "social-light wedding." At left, the radio-tube clergyman



ELECTRIC-LIGHT bulbs and radio tubes form the basic materials with which Alfred Wronkow, of New York City, fashions the amusing caricature figures shown above. For the "social-light" wedding scene pictured,

Wronkow used common household items to dress the principals and attendants at the fusing of "Claire Coppertop," a dainty twenty-five-watt bride, and "John Glasstummy," her husky seventy-five-watt groom.



Particles of Smashed Atoms Traced by Special Camera

SIXTY-SIX separate photographic plates are employed in an atom camera with which Prof. T. R. Wilkins, of the University of Rochester, Rochester, N. Y., hopes to gather new scientific data on the repulsive force within the nucleus of an atom. Bombarded in a cyclotron, or atom smasher, atomic particles enter the circular camera, approach a central target, and are "scattered" through pinholes into one or more of sixty-six slots, each of which has a photographic plate bearing a special emulsion on which the atom particles leave "tracks."

Flexible Engravings Used in Printing

BECAUSE the demand for metals in Germany far exceeds the supply, scientists have developed a substitute for the copper and zinc normally used in making engravings for reproducing photographs and other illustrations. Made of a rubberlike composition which is flexible, the engraving is provided with an adhesive backing which is protected by a sheet of gauze during shipment and handling.



Engraving plate of synthetic flexible material, compared with an ordinary metal plate

Searchlight Mirror Creates Odd Photo

WHILE a visitor at the Museum of Science and Industry in New York City was examining a forty-four inch parabolic mirror on display there, an alert photographer snapped the curious photograph at the right. The giant mirror, designed for use in huge searchlights that project 1,000,000-candlepower light beams, is one of the attractions in the museum's hall of optical science, along with scores of displays including a miniature working model of a glass-manufacturing plant, graphic demonstrations of refraction, reflection, and other optical principles, and effects of polarized light.



The reflection in the parabolic mirror gives a Siamese-twin effect

Thirty-Foot Bridge Model Carved by Hand

CARVED entirely by hand, a thirty-foot wooden model of the Delaware River bridge that connects Philadelphia, Pa., and Camden, N. J., was recently completed and put on display by Dominick de Gregorio, of Philadelphia, after a total of nearly 15,000 hours of labor extending over a period of six years.

Although the model span is made entirely of balsa, a wood lighter than cork, it tips the scales at more than 600 pounds. The only tools used in the construction of the miniature bridge reproduction were razor blades and a set of specially designed knives which the model builder made himself.



Dominick de Gregorio with his model of the Delaware River bridge at Philadelphia, Pa. He worked six years at it



What Makes a Champion?

BY BERTON BRALEY

The thing that makes a Champion is obvious enough;
It isn't any mystic prestidigitator's stuff.
It's nothing more than giving to whatever be the chore
The power that is in you—and a small scintilla more.

It isn't any wizardry, it's not a magic gift,
It's merely lifting honestly the load you have to lift,
Or, in the game you're playing, it is using all your store
Of grit and nerve and energy—and just a trifle more.

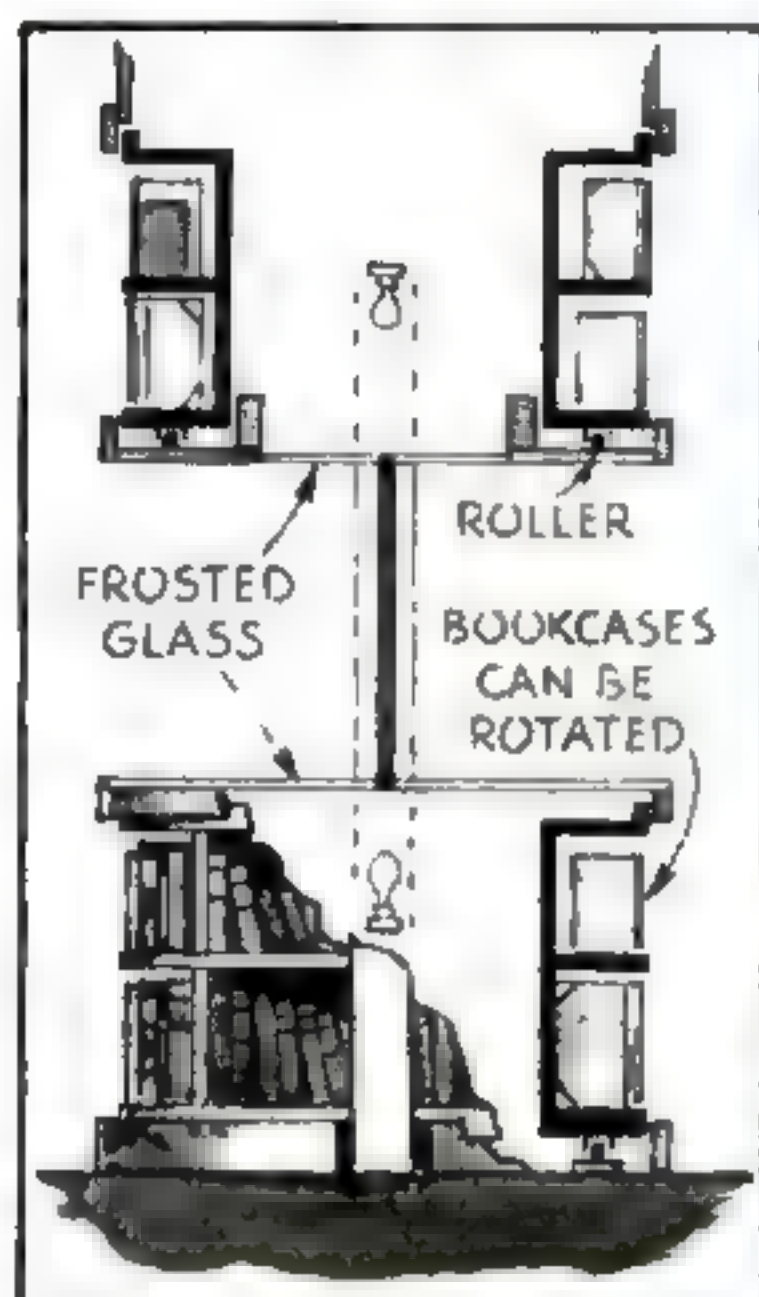
The thing that makes a Champion is simple, plain, and clear;
It's never being "almost," "just about," or "pretty near"
It's summoning the utmost from your spirit's inner core
And giving every bit of it—and just a little more.

"That little more—how much it is!" As deep and wide and far
As that enormous emptiness from dunghill to a star,
The gulf between the earthbound and the eagles as they soar,
The Champions who give their best—and one iota more!

Streamline Apartment Has Glass Walls

Ultramodern dining room with legless table suspended from the ceiling by a luminous glass tube

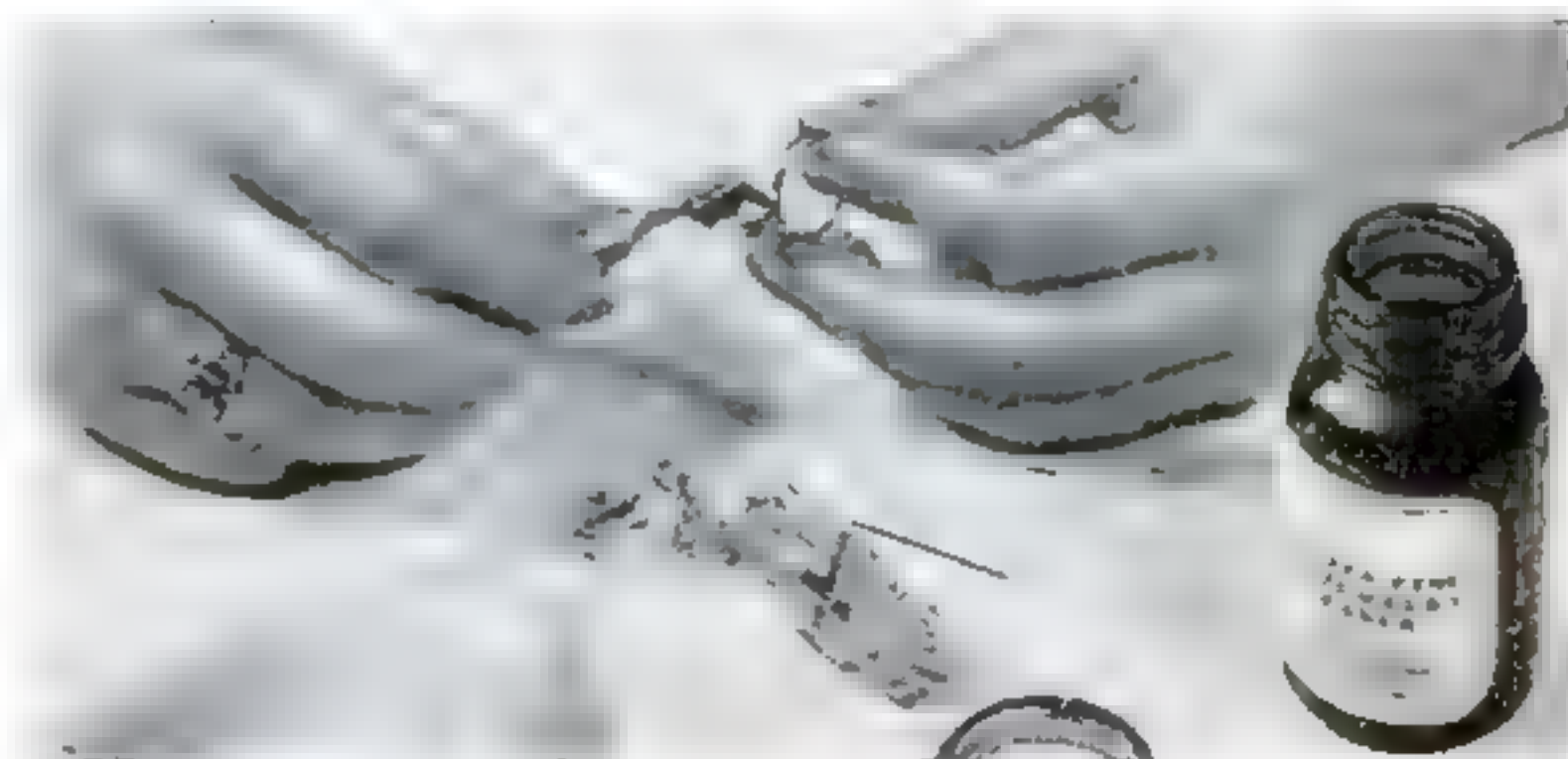
Drawings below show details of the revolving bookcase built into the wall between the living room and the bedroom



A LEGLESS dining-room table suspended from the ceiling by a internally lighted glass tube, a streamline desk with radio, barometer, thermometer, and clock built into a desk-top dashboard, a circular wall bookcase that revolves to allow volumes to be reached from either the bedroom or the living room—these are some of the outstanding features of a model apartment designed by Count Alexis de Sakhnoffsky, well-known industrial designer. Set up for display in a New York City department store, the ultramodern apartment utilizes various new plastic materials, glass walls lighted from behind by fluorescent lamps, and a circular fireplace set in the wall between the dining and living rooms so that it may be seen from either.

Liquid Jewelry Cleaner Makes Diamonds Shine

DIAMOND rings, bracelets, brooches, clips, and other articles of jewelry are said to take on a brilliant sparkle and luster when treated with a liquid jewelry cleaner recently marketed. Included in the kit with the chemical cleaning fluid are a polishing cloth and a tiny brush for applying the liquid in crevices.



Cleaning fluid is applied with a tiny brush and a cloth

Tigers

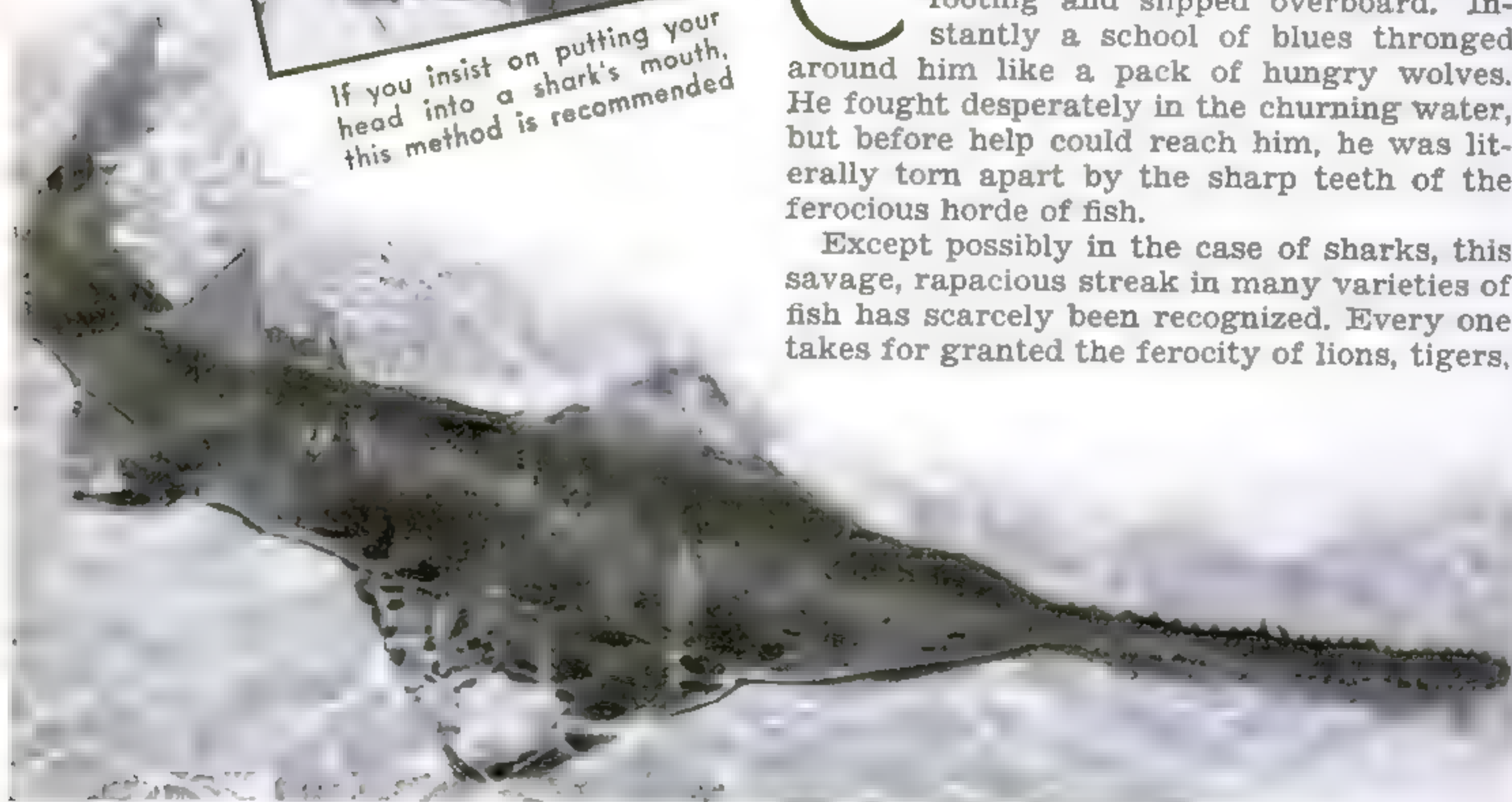


If you insist on putting your head into a shark's mouth, this method is recommended

Most dreaded of all the creatures inhabiting the sea, to landlubbers at least, is the shark

CASTING for bluefish off Fernandina, Fla., not long ago, an angler lost his footing and slipped overboard. Instantly a school of blues thronged around him like a pack of hungry wolves. He fought desperately in the churning water, but before help could reach him, he was literally torn apart by the sharp teeth of the ferocious horde of fish.

Except possibly in the case of sharks, this savage, rapacious streak in many varieties of fish has scarcely been recognized. Every one takes for granted the ferocity of lions, tigers,



This photograph of a sawfish in shallow water shows its dangerous sharp-toothed weapon

of the Deep

**For Sheer Savagery,
Fish Are Unequaled
by Any Land Animals**

**By
C. BLACKBURN
MILLER**



This is the tiger fish, of the Congo River. At the upper right is a shark



bulls, and other land animals, although few species will actually attack man without some provocation. Yet the average person is completely unaware that fish exhibit a savagery and voraciousness unparalleled among any other living creatures that inhabit the earth.

Take that gangster of the deep, the swordfish. Although his daily diet con-

sists mainly of small butterflyfish, he's a fighter at heart. Mariners have seen 500-pound swordfish battling forty-ton whales, in a sea dyed red with blood. Swordfish have attacked many a vessel, driving their four-foot daggers through stout oak planking.

Capt. Alfred Cyr of the sloop *George A* can testify to the savage temperament of the swordfish. Once, he told me, he harpooned one and set out in a dory to kill the fish with a lance. Without warning the swordfish turned on the dory, charged

ahead, and thrust its sword clean through the planking, as easily as a butcher skewers a roast. Cyr was struck on the chest by the sword, which would have sliced its way through his body if he had been standing a foot closer.

While cruising off the eastern tip of Long Island, N. Y., Capt. John Maxson had almost as narrow an escape when a harpooned swordfish drove its spear through the dory planking just at the water line. Thinking quickly, Maxson grabbed a line, threw a couple of half hitches around the sword, and hung on to the thrashing fish until help arrived.

Very few people seem to be aware of the fact that

SPORT FOR OCEAN HUNTERS

The angler at the left is engaged in a battle with a swordfish. Below, a shark being dragged in after a stiff fight. In circle, the business end of a tarpon, showing the cutting plates on the jaw



marlin are almost as dangerous as swordfish, although they are equipped with a rounded rapier instead of a flat, pointed sword. Blue and black marlin, growing to a weight of 1,000 pounds or more, have been known to attack boats without the slightest provocation. Only a few months ago, passengers aboard a cruiser bound for Bimini suddenly felt a thudding shock. Going below to investigate, the captain discovered the bill of a marlin protruding through the hull, its point buried within the metal gas tank.

Ferocious as they are, neither the swordfish nor the marlin possesses the terrifying dental equipment of the shark.

Just why some persons, even those who pose as authorities, insist that sharks will not attack human beings, is a mystery to me. For there have been numerous authenticated instances where white, blue, brown, tiger, and mackerel sharks have attacked and killed swimmers. In Australian waters, safety officials have been forced to inclose whole bathing beaches with strong, sharkproof nets.

Owing to a primitive nervous system, sharks appear to be unaffected by either pain or shock, and will continue to attack until completely exhausted through loss of blood. The only way to down them is to hit a vital spot such as the brain or heart.

A few years ago, I was fishing from a small scowlike boat off the flats near Cape Sable, Nova Scotia, with Sam Bonnell, well-known sportsman and angler. One morning we sank an iron into a large tiger shark and were scudding along in its wake as it headed seaward, the forty-foot harpoon line taut as a fiddle string. Suddenly,

without warning of any kind, that shark circled and came straight for our frail boat.

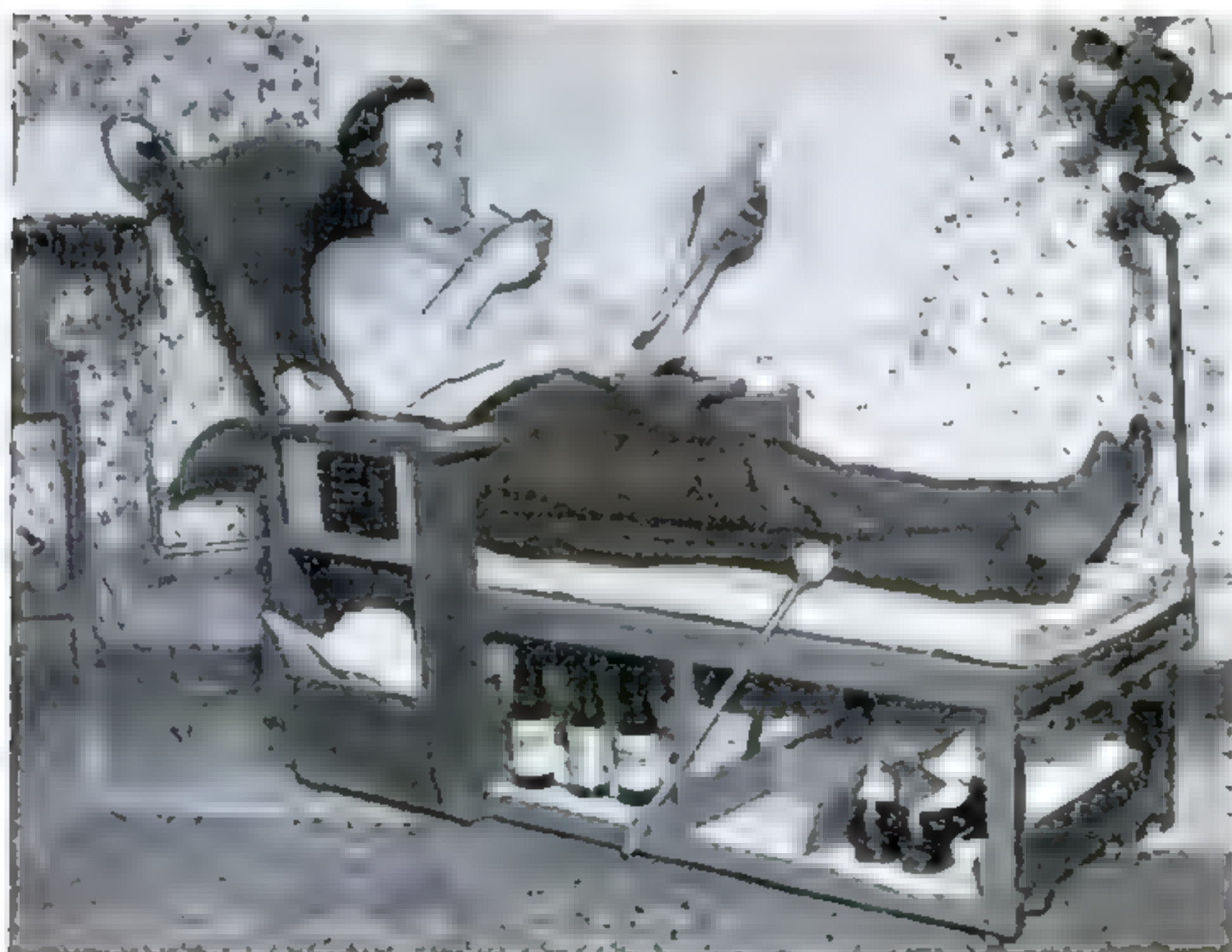
Bonnell drew his .45 caliber service automatic and I raised my .25-20 repeating rifle. Together we began a barrage at the shark while it was still about twenty feet away. I saw the bullets plow into its body, but we might as well have been using bean shooters for all the good it did in halting the shark's charge. Bonnell swung our little craft's stern to the oncoming shark. As we crouched in the bow, our weight raised the stern several feet from the surface just in time to meet the giant fish, which smashed into the boat and splintered the stern with *(Continued on page 211)*

Tiny Bombs Put Sodium in Vapor Lamps

TINY bombs, exploded inside light bulbs, are being used to put the sodium in sodium-vapor lamps for highway illumination, in a method developed recently by General Electric research engineers. Because sodium is so active chemically and tends to combine directly with most non-metallic elements, it must be placed within the glass lamp bulb without exposing it to the air. This is done by running the sodium through a complicated distilling process which ends with one eightieth of an ounce of the element sealed in a tiny glass bomb. After the miniature bomb is placed within the tubular glass lamp, the air is drawn from the latter, and a high-frequency coil placed around the tube. Heat induced by this coil gradually raises the temperature of the sodium until it bursts its glass container and frees itself within the lamp. Since it is only six one-thousandths of an inch thick, the glass bomb casing shatters into dust, which can safely be left within the lamp. Before the development of the miniature-bomb method, the sodium was distilled separately into each lamp.



Tubular sodium-vapor lamp bulb and the miniature bomb that is exploded inside it. Above, distilling sodium into bomb



Bill Porter taking it easy in his homemade easy chair. Note "gearshift"

Homemade Chair Has Seventeen Aids to Comfort

COMFORT-LOVING Bill Porter, East St. Louis, Ill., handy man, takes no chances on having to get up for anything once he's settled in his easy chair. For the chair, which Porter designed and built, is equipped with seventeen convenient accessories, including a radio, bookcase, electric fan, shoe-shining and pipe-smoking equipment, and compartments for food and beverages. A pull on a "gear-shift" lever lowers the back, converting the chair into a bed.



Tank Walks Tight Rope of Bridge Piles

LIKE a Gargantuan beast stalking along a giant's tight rope, an armored Russian tank is pictured in the unusual photograph above crossing a stream by rumbling over the tops of the piles of a dismantled bridge. The shot

was made during the filming of a motion picture built around the activities of the Red Army, for release as part of a celebration marking the twenty-first anniversary of the founding of the Soviet fighting forces.

Giant Cross-Word Puzzle

WHICH is the largest cross-word puzzle ever made? A leading candidate, now on the market, is a puzzle embodying 3,071 words. Said to require the average fan a year to solve, the puzzle measures thirty-four by twenty-eight inches. Answers are supplied in a sealed envelope.

Novel Shoe-Whiting Aid

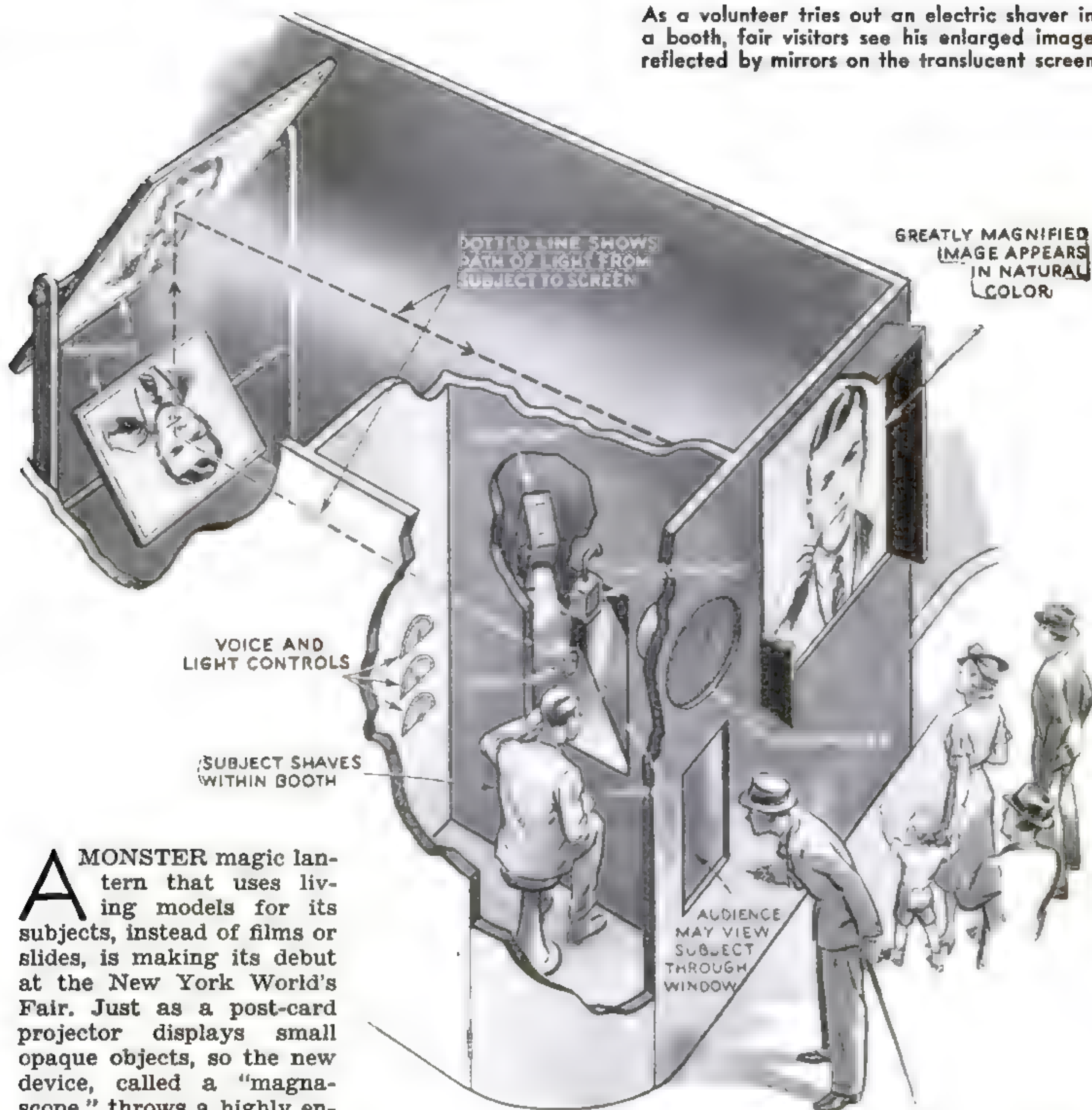
PLACED between the sole and upper of a summer sport shoe, at any point along the sole or heel, a metal plate of specially designed shape makes it easy to apply shoe whiting without getting it on the sole.



This puzzle is designed to take you a year to solve

Projector Makes Living Movies

As a volunteer tries out an electric shaver in a booth, fair visitors see his enlarged image reflected by mirrors on the translucent screen



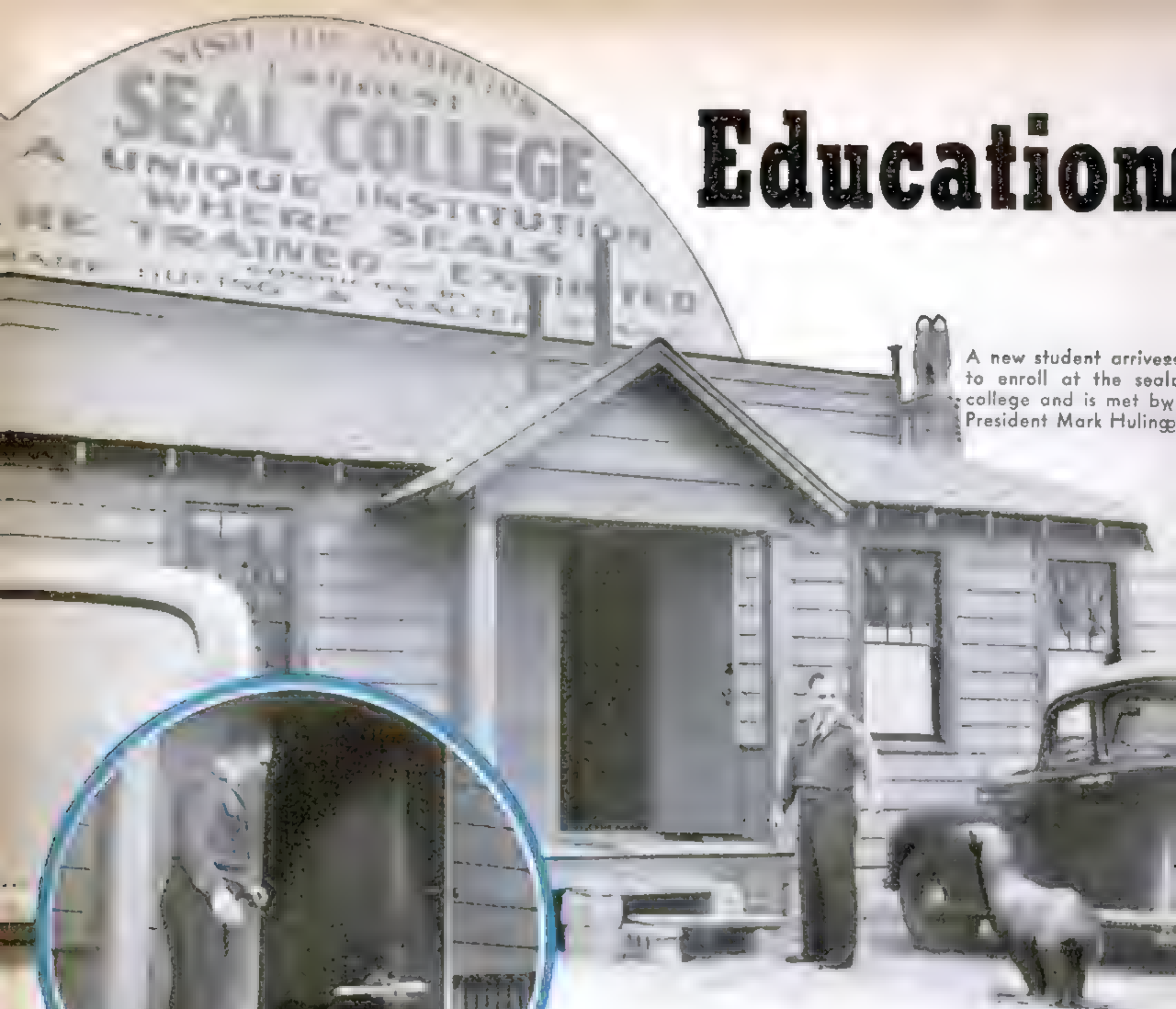
A MONSTER magic lantern that uses living models for its subjects, instead of films or slides, is making its debut at the New York World's Fair. Just as a post-card projector displays small opaque objects, so the new device, called a "magnascope," throws a highly enlarged image of a man's face upon a translucent screen. Meanwhile, a microphone picks up the voices of the subject and operator, and the audience hears them through a loudspeaker, so that the effect is that of a talking motion picture projected as fast as it is produced.

In its first application, the magnascope gives spectators a close-up view of what happens when a man shaves with an electric razor. Unshaven chins look like forests of tree stumps upon the screen, and the bristles fall like cordwood as the razor sweeps across them.

Chosen at random from crowds of visitors

to the exhibit building, a subject sits within a booth where powerful spotlights illuminate his face. His reflection from a slanting mirror is picked up in turn by a series of condensing and magnifying lenses, and two larger mirrors. The last mirror reflects the image to the screen, where the audience sees it. By adjusting the positions of the mirrors, the operator regulates the degree of magnification, which the inventor, William Herrschaft, declares may be stepped up to as many as thirty diameters without distortion. Spectators may peer also through a window of the projection booth and see the subject.

Education



A new student arrives to enroll at the seal college and is met by President Mark Huling.

In the main classroom, below, undergraduates study juggling, diving, and other tricks. Fish reward good work.

School days past, he leaves with a diploma.



Pupil and teacher ponder a problem.



of a Trained Seal



Rolling a ball back and forth along a grooved stick is a hard stunt to learn

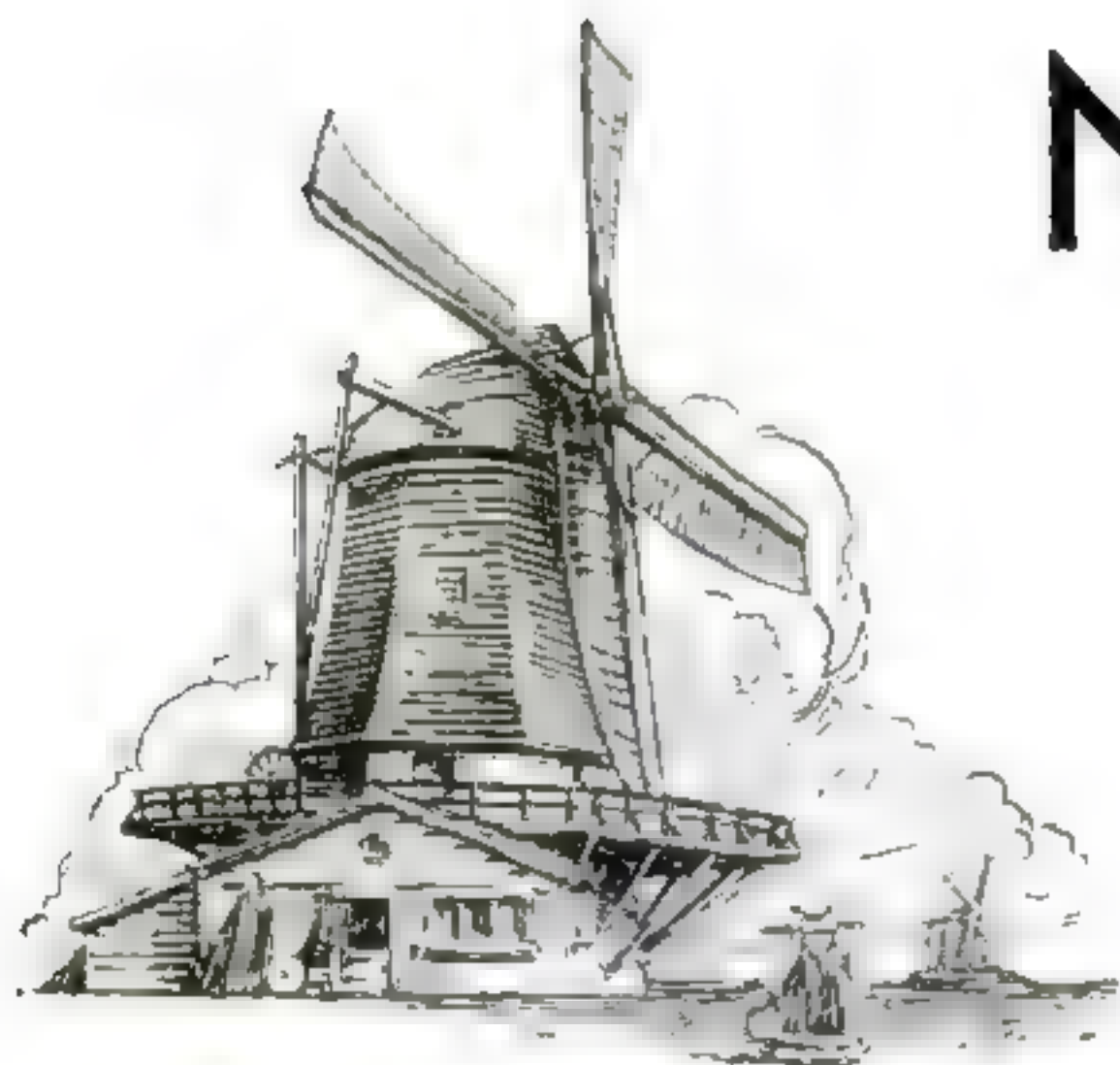
"And this is a ball." A student looks over the school equipment

ABILITY to swim and a liking for raw fish are the sole entrance requirements at a novel school in Kingston, N. Y. Here, separated by a continent from their home off the California coast, seals are trained to juggle balls, blow horns, balance water-filled glasses, and perform a wide variety of other tricks during their course of study at what is said to be the largest "seal college" in the world. The main classroom boasts of a large swimming pool, a bathtub, a high-diving board with an open-stairway approach, and wall racks for balls, rings, and

other paraphernalia. Here the animals learn their lessons under the expert guidance of Mark Huling, who has been training seals for twenty years. When starting their academic careers as "green" freshmen, the aquatic collegians range in age from five to fifteen, and weigh in for their initial physical exam at around 200 pounds, stripped. After an elementary period in which they become acclimated and learn to acknowledge Huling as the boss, the flippers graduate to sophomore status and begin learning simple tricks, each of which requires several weeks of repetitious study, a half hour each day. Rewards for good deportment and high marks take the form of fresh fish. By the time they are seniors, the seals have demonstrated the benefits of education, since their untrained value of \$100 has soared to as much as \$4,000.

New Schemes for

INVENTORS PROPOSE STRANGE PLANS



European-type windmills like this have enormous sails that sweep the air in circles sixty to eighty feet in diameter

IS THE windmill coming back? With strange, unconventional types, inventors are seeking to adapt it to a modern age. Their experiments may bring new success in man's effort for 800 years or more to harness the wind for power.

Centuries ago, people milled their flour, sawed wood, and pumped water with the picturesque European windmills whose enormous "sails" swept from earth to sky. This country contributed the smaller and more practical narrow-bladed type that pumps water on farms today. A new miniature design shaped like an airplane propeller charges storage batteries for radios and for lighting rural homes.

To provide power on a larger scale, giant structures envisioned by modern designers would reach heights where winds constantly blow. One inventor, Hermann Honnef, proposes to mount 500-foot wheels, with spokes that serve as vanes, upon high towers. A single "skyscraper windmill" of this type, he estimates, would generate enough electricity for a city of 100,000 inhabitants. Another designer, Peter Bendmann, offers plans for a pair of giant windmills, connected at right angles to each other and arranged to move around an endless track so as to obtain maximum power in wind from any direction.

At Burlington, N. J., recently, a spool-shaped rotor ninety feet high strained at its moorings with a ten-ton horizontal pull, when an electric motor spun it in the wind. The inventor, Julius D. Madaras, plans to mount twenty such rotors on flat cars, and make the wind propel the whole train around a circular track. Dynamos geared to the car wheels would generate many times the amount of power needed to turn the rotors, and the surplus would be marketed.

Primitive wind power plants in Greece, with their delicate sails and rigging, offer a contrast with familiar kinds



Americans can design windmills to beat the Dutch. As this photograph proves, the more efficient narrow-blade type has even invaded the land of the dikes



Harnessing the Winds

TO BRING THE OLD DUTCH MILL UP TO DATE

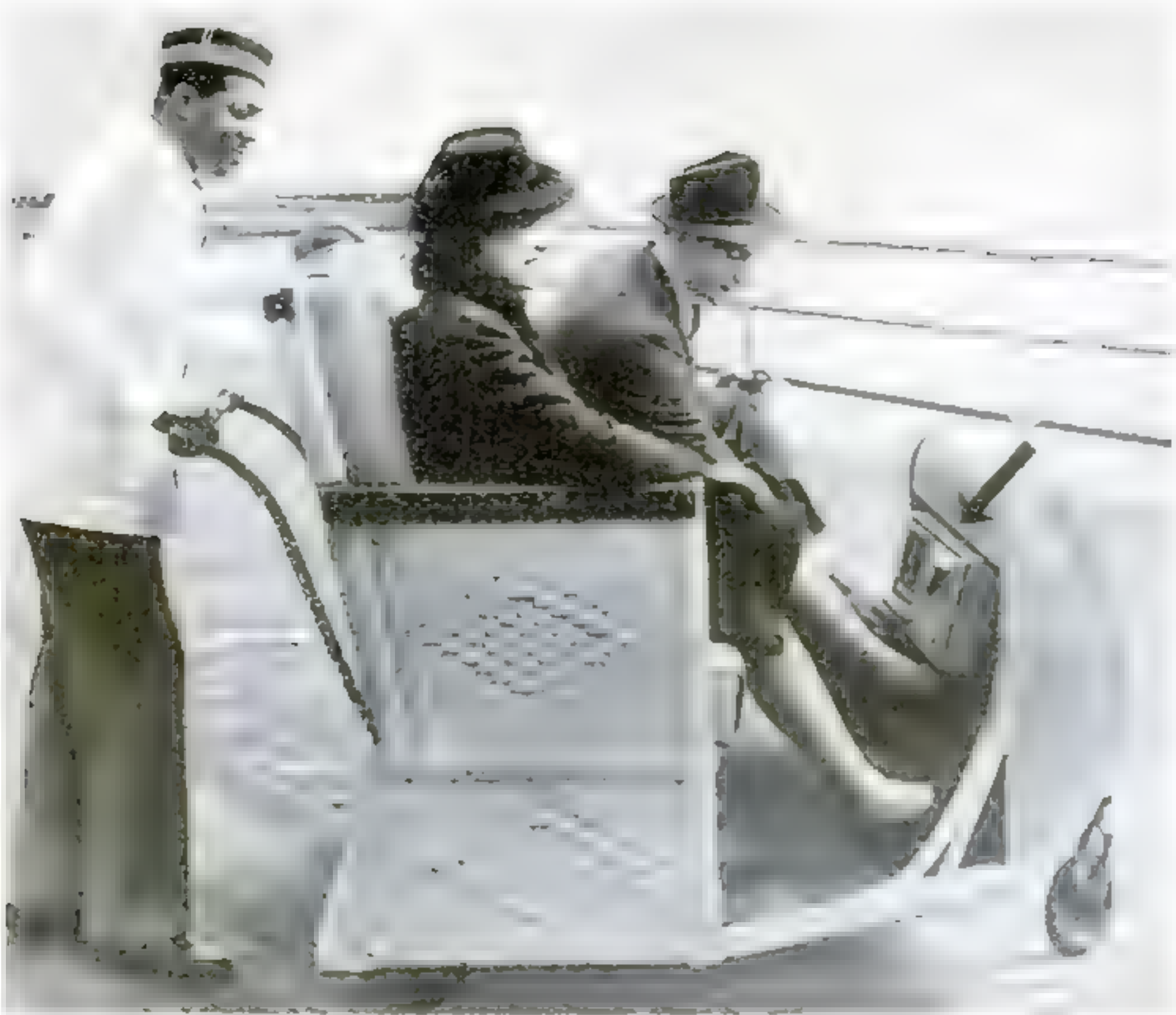


Hermann Honnef and a model of the 500-foot wind wheels he proposes to erect on tall towers. At far right is a rotor-type "windmill" recently tried out. Twenty of these on flat cars would run around a track to generate electricity



POWER FROM ANY WIND

This is a model demonstrating the plan of Peter Bendmann for a pair of huge wheels which adjust themselves to face the wind



Seashore vacationists tune in to see what the wild air waves are saying

Boardwalk Wheel Chairs Have Radios

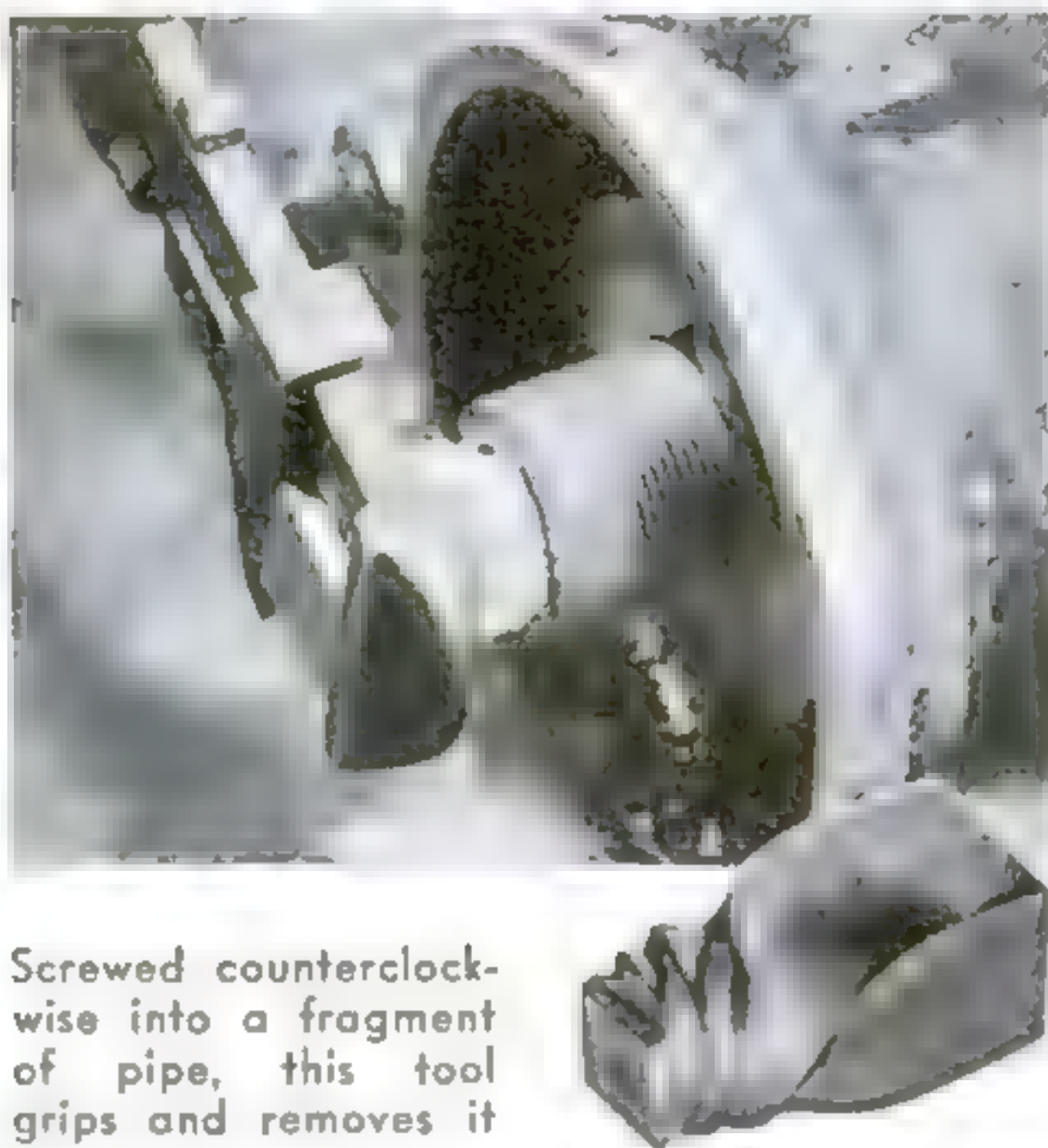
IF CONVERSATION lags, or the sound of the surf pounding onto the beach becomes too monotonous, passengers in wheel chairs used on the boardwalk promenade at an Atlantic seaside resort can lean forward, flip a switch, and sit back to listen to music, drama, political speeches, or even weather reports on how hot the day is back home. For the chairs are now equipped with built-in, battery-operated radio receivers installed at the front of the wicker bodies of the vehicles.

Budding Tree Surgeon Collects Driftwood

ADD driftwood to the ever-growing list of unusual things that hobbyists are collecting. Fourteen-year-old Marvin Gerard, of Owosso, Mich., who plans to be a tree surgeon when he grows up, spends his spare time on the shores of Lake Huron collecting driftwood in queer shapes that resemble dogs, cats, birds, human profiles, and other objects.



Marvin Gerard with some of his trophies from Lake Huron



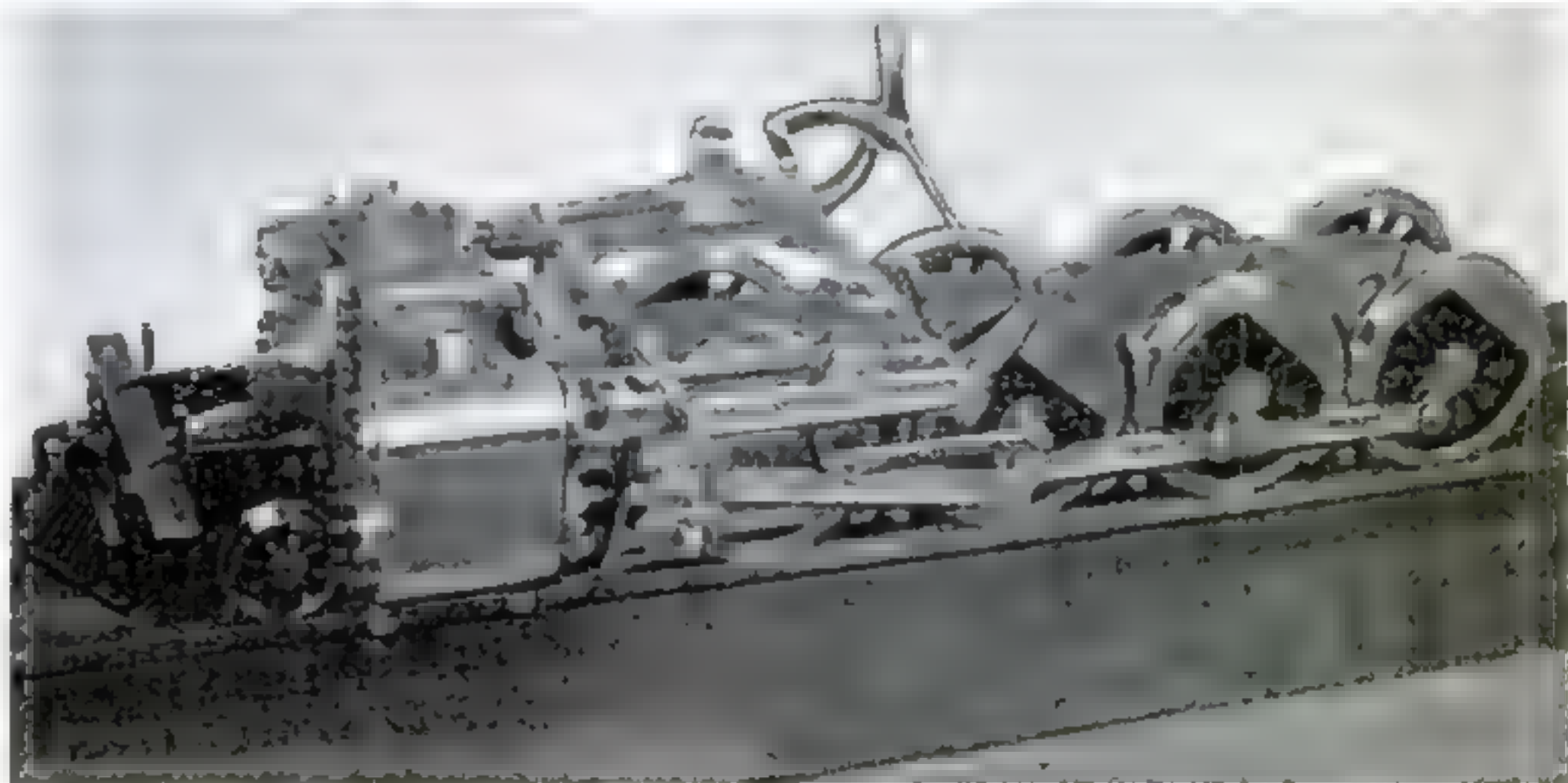
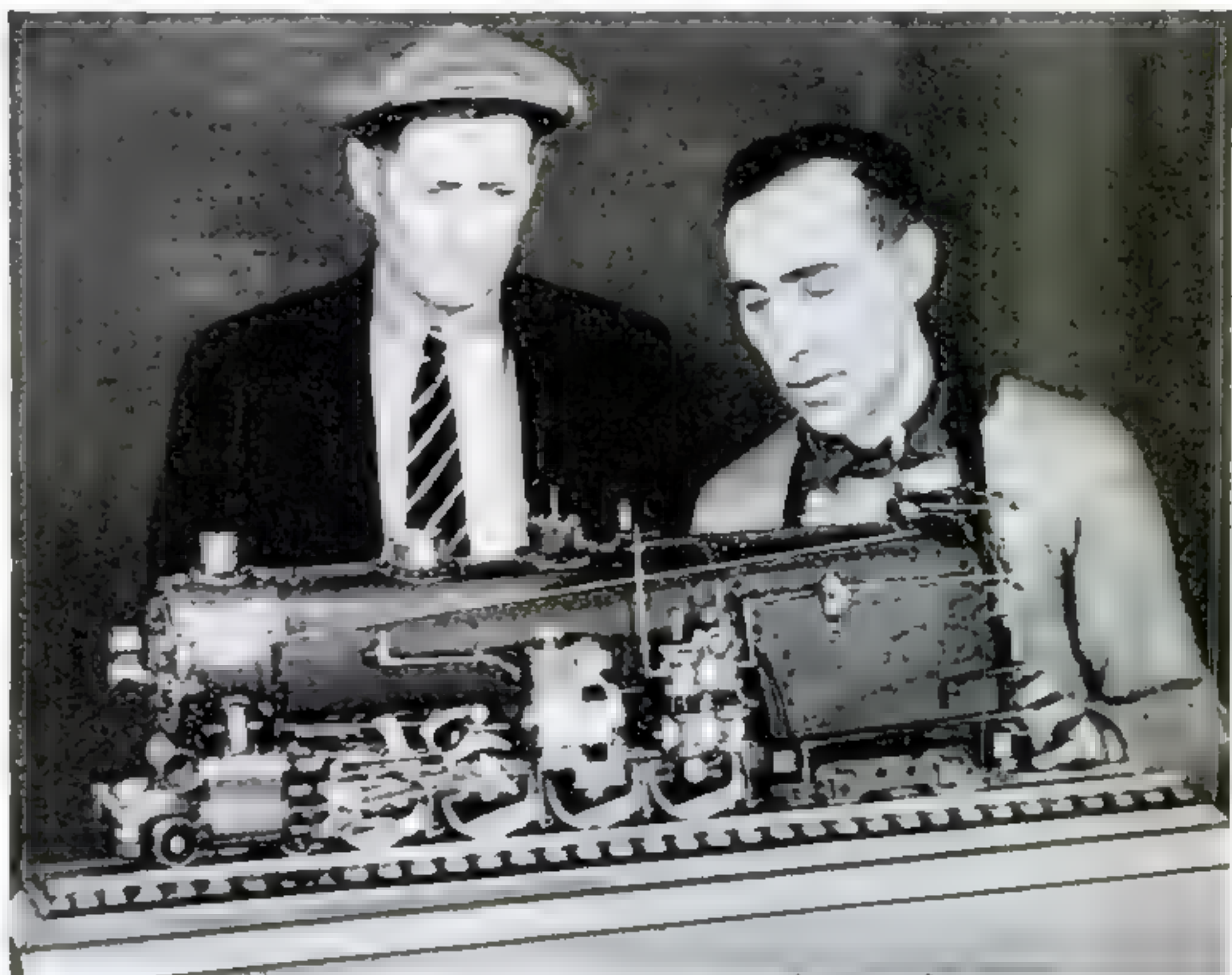
Screwed counterclockwise into a fragment of pipe, this tool grips and removes it

Novel Extracting Tool Grips Broken Pipe

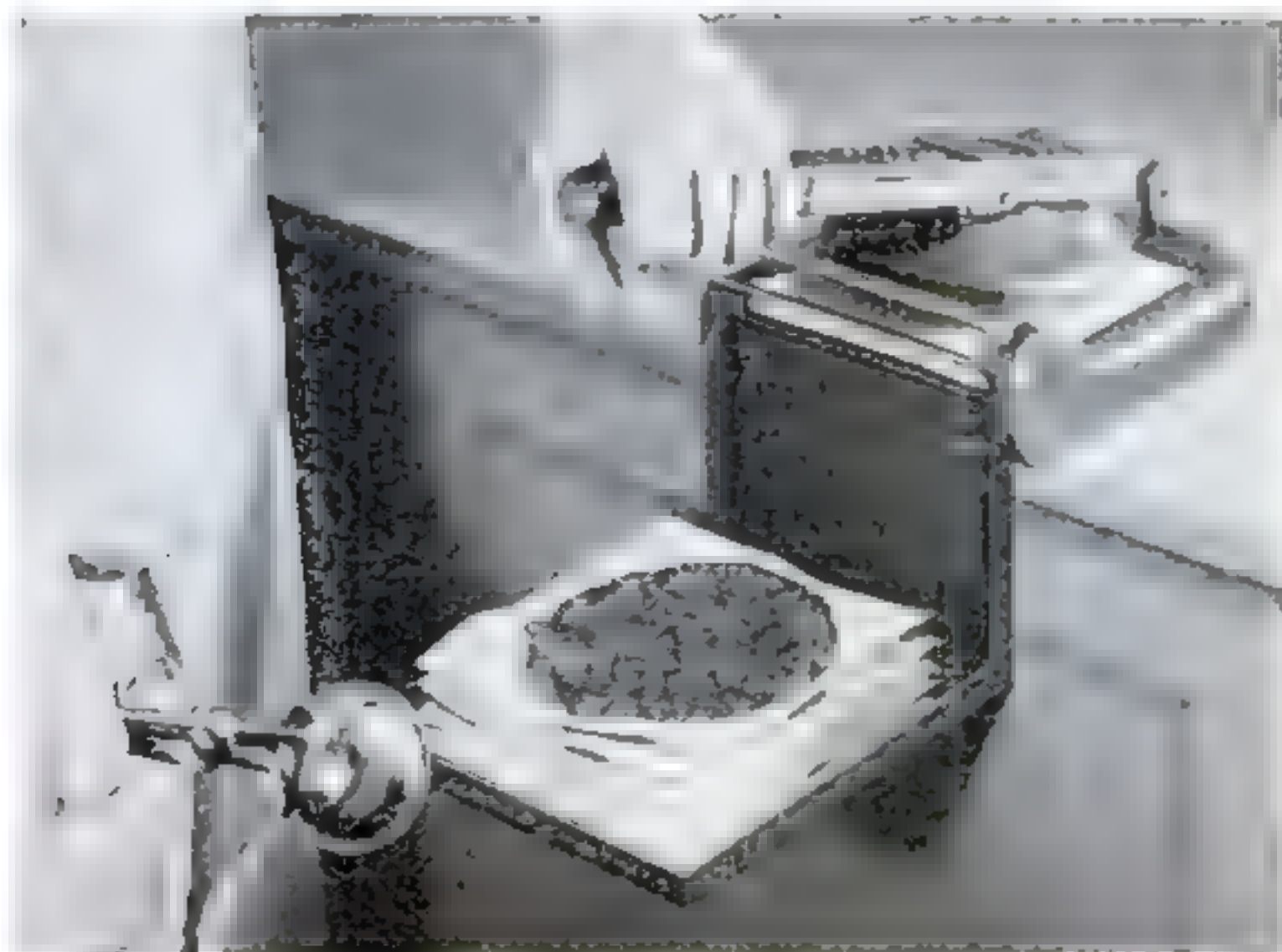
REMOVING the stubby ends of broken pipes is made easy with a handy tool now on the market. Made of the finest steel, the unit is threaded in the reverse direction from the normal. Screwed counterclockwise into the pipe end, it takes a grip on the metal and makes it a simple task to turn the pipe stub out in the direction of its threading. The pipe-extracting tool is shown in use in the photograph above. An ordinary wrench is used to turn the device.

Everything Works on this Engine Model

MORE than 6,000 separate parts are included in the remarkable live-steam model locomotive built by Art Jennings, of Carmel, Calif., in his home workshop. Three years ago, Jennings started his project, modeling his locomotive after a Southern Pacific 4-8-4 mountain type, detailed plans of which he secured from the railroad's engineering department. Before he finished, Jennings had spent about 10,000 hours of work studying engineering, building a small foundry for casting scale parts, and assembling the units into the finished 100-pound model. Besides the usual small tools, and the special equipment which he constructed himself, his shop equipment consisted of a screw-cutting lathe, a small, bench-type drill press, and a seven-inch metal shaper, all standard home-workshop equipment. Built to half-inch scale, the locomotive boasts a fully equalized air-brake system, Walschaert valve gear, scale water and air pumps, reverse gear, and countless other features.



Art Jennings, of Carmel, Calif., (right) explains his nearly finished steam-powered locomotive model to a friend. He made each of its 6,000 parts by hand. The complicated valve system is detailed in the lower photograph

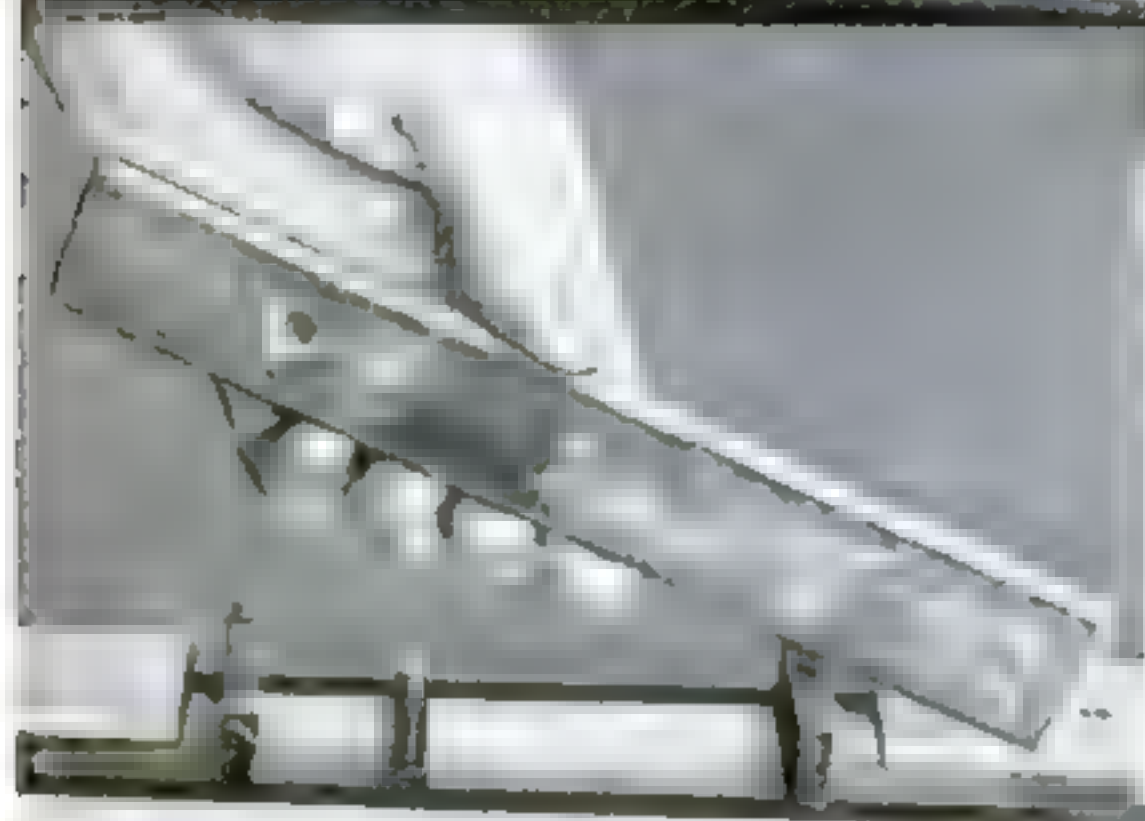
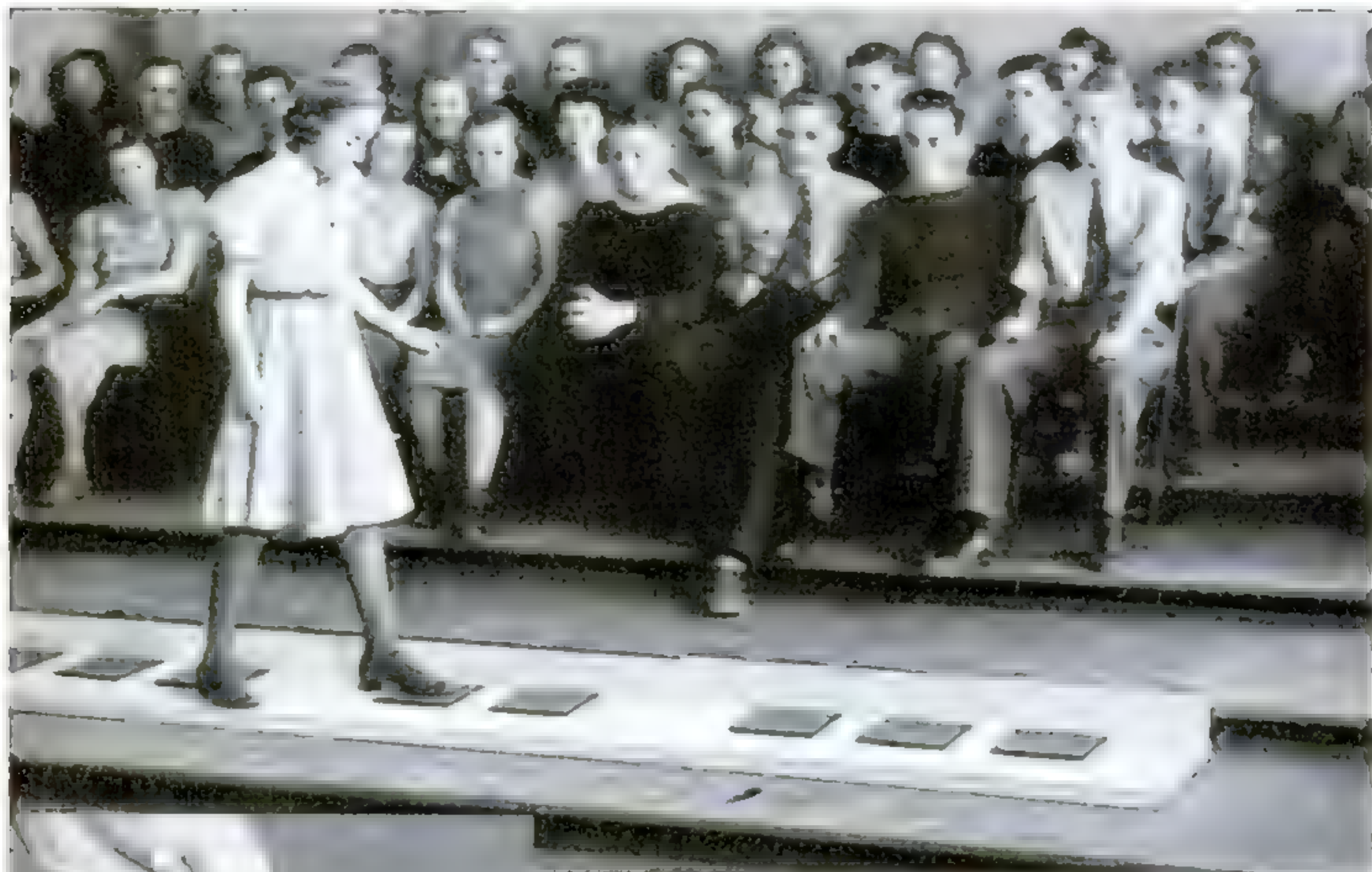


Short-order cooks will appreciate this hamburger presser

Press Molds Hamburgers into Uniform Size

HAMBURGERS are shaped to uniform size and thickness by the hand-operated machine pictured at the left. Ground meat, scooped up with a dipper or other measuring unit, is deposited on the machine on top of a sheet of waxed paper. When the handle is pulled down, the meat is pressed into a flat, patty shape. As the handle is released, the waxed paper and the hamburger are ejected onto a tray attached to the machine. By making the meat cakes all of the same size and thickness, the cooking time of each becomes uniform.

Piano Students Use Giant Keyboard

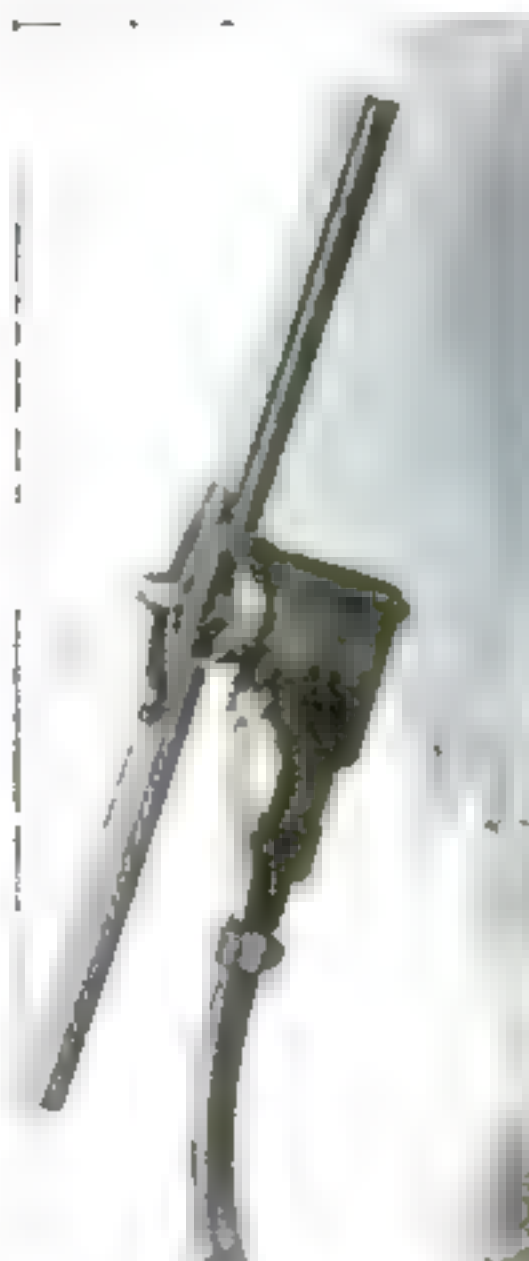


Literally "running up the scales" to learn them. The keys are treadles which operate tuned tone bars like that seen at left

WHEN Arthur Zahorik, a high-school music teacher in Milwaukee, Wis., tells a student to "run up the scales" he means it literally. For on the classroom floor stands a two-octave model of a giant piano keyboard, with white keys a foot wide, upon which students step to demonstrate their mastery of chords and scales. Each of the keys is actually a treadle which, when depressed, closes an electrical contact, causing a metal rod to strike a tuned metal plate and sound the correct note.

Whirling Wiper for Windshields

WHIRLING at controllable speeds up to 2,500 revolutions a minute, a rotary windshield wiper for airplanes, trucks, busses, and boats clears a circular field of vision with blades that are invisible when in action. Mounted directly on the windshield, and driven by an electric motor, the driving head passes through a hole in the glass and carries the wiper blades. In winter, de-icing fluid can be fed to the edges of the blades.



A flexible cable driven by a motor whirls the windshield-wiper blades

Crowns of Courage

Remi Desrivieres with some of the model crowns he makes for advertising displays



Now he has six men working with him at the novel craft. Most of them are invalids like himself

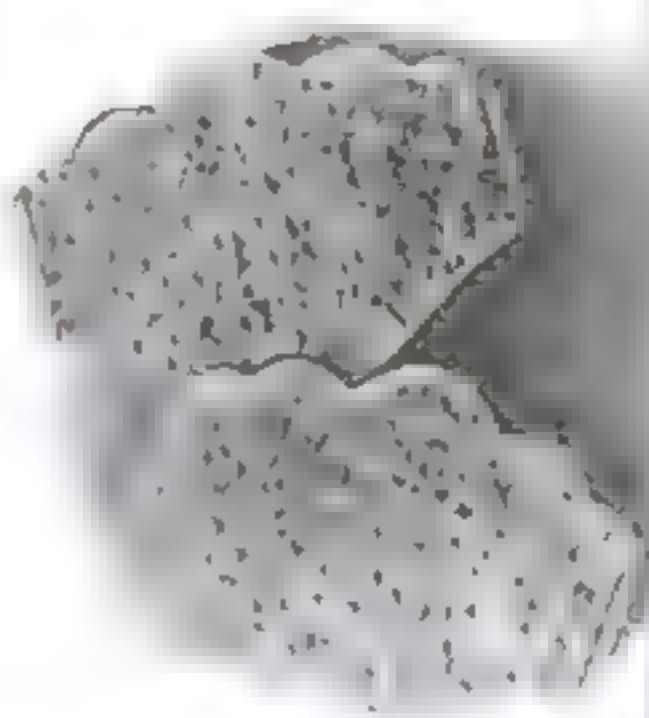
Friends praised the quality of his handiwork, and he determined to start large-scale production. Enlisting the aid of other invalids, Desrivieres formed the "Royal Crown Syndicate," with himself as president, to manufacture and sell the decorative novelties. From a wheel chair in the hospital, he has been directing the six-man force that helps him turn out the crowns. Made in three sizes, each consists of 172

CRAFTSMANSHIP and enterprise have given a new start in life to Remi Desrivieres, fifty-year-old invalid in an Ottawa, Canada, hospital. When he was stricken with an illness that deprived him of the use of his legs, he took courage from the fact that his hands remained nimble and talented. As a pastime, he fashioned several models of British crowns in honor of the visit of the King and Queen of England to Canada.

different parts. Gold paint covers a framework of heavy cardboard, glued together, and multicolored pieces of glass accurately simulate the British crown jewels. White absorbent cotton, wound on wire and spotted with black, represents the ermine at the base of the crown; and a lining of red velvet enhances its appearance. The invalid executive is looking now for new craftwork products to keep his "factory" humming.

Foot Pads Prevent Bathtub Falls

TO PREVENT dangerous bathroom accidents due to falls on slippery tile or porcelain, Miss K. W. Hoegger, of Weehawken, N. J., devised the handy safety foot pads shown at the right. Fitted with a shredded-cork surface, said to insure a better grip than sponge rubber or similar materials, the pads are slipped over the feet and held in place with elastic bands. Worn while bathing, the pads reduce the danger of slipping while getting into or out of the tub.



Adhesive-Tape Cutter Fits on Roll

ADHESIVE tape is easily cut from a roll with the aid of an attachment now on the market. Supported on two arms that fit between the adhesive roll and the sides of its metal spool, a cutting blade rests on the tape, making it a simple matter to rip off the adhesive in any length desired, by drawing it across the keen blade edge. The cutter moves toward the center as the roll of adhesive is used up.



Curved arms hold blade on tape for cutting, as seen at right



No danger of slipping in the tub. She wears foot pads like those shown at the upper left

Rubber "Balloons" Keep Food Fresh

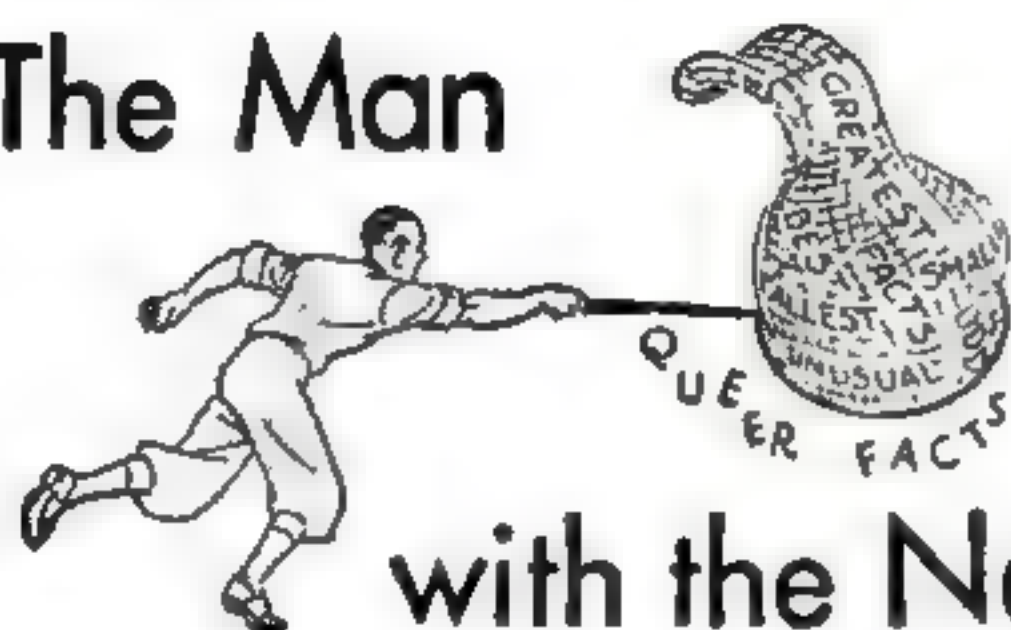
DRESSED fowl, meats, and other perishable foodstuffs are now packed in sealed rubber "balloons" to prevent air from spoiling them before purchase by consumers. A piece of thin rubber is stretched over the mouth of a

vacuum packing container, which sucks in the fabric to form a bag. The food is then inserted, and the bag ends closed over a vacuum hose that removes all air from the rubber food package, which is then sealed.



Packing a chicken in rubber. The fowl is inserted in the "balloon" and sealed in after the air is withdrawn

The Man



with the Net

TEMPERATURES in the Sahara Desert drop as much as 130 degrees between mid-afternoon and night.

TRUCKS transporting valuable silks in New York City are equipped with burglar alarms.

STREAMS in the United States develop 419,000,000 horsepower as they flow to the sea.

OSTRICHES can kick in only one direction, forward.



WALT DISNEY'S animated moving picture, "Snow White and the Seven Dwarfs," would have required 250 years to complete if one artist had made all the drawings.

WATER in Great Salt Lake, Utah, is five times as salty as water in the Atlantic Ocean.

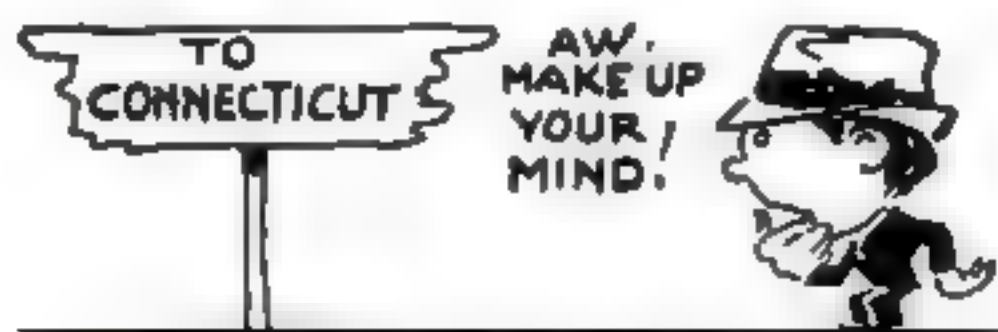
HENS that lay 200 eggs a year require only ten percent more food than hens that lay 100 eggs a year.



MEADOW MICE breed so rapidly one pair could have as many as 1,000,000 descendants at the end of a year if none were killed.

GOLDFISH do not develop tuberculosis even when fed large quantities of tuberculosis bacteria.

WALKING either east or west from one spot in Massachusetts, a pedestrian will enter Connecticut.

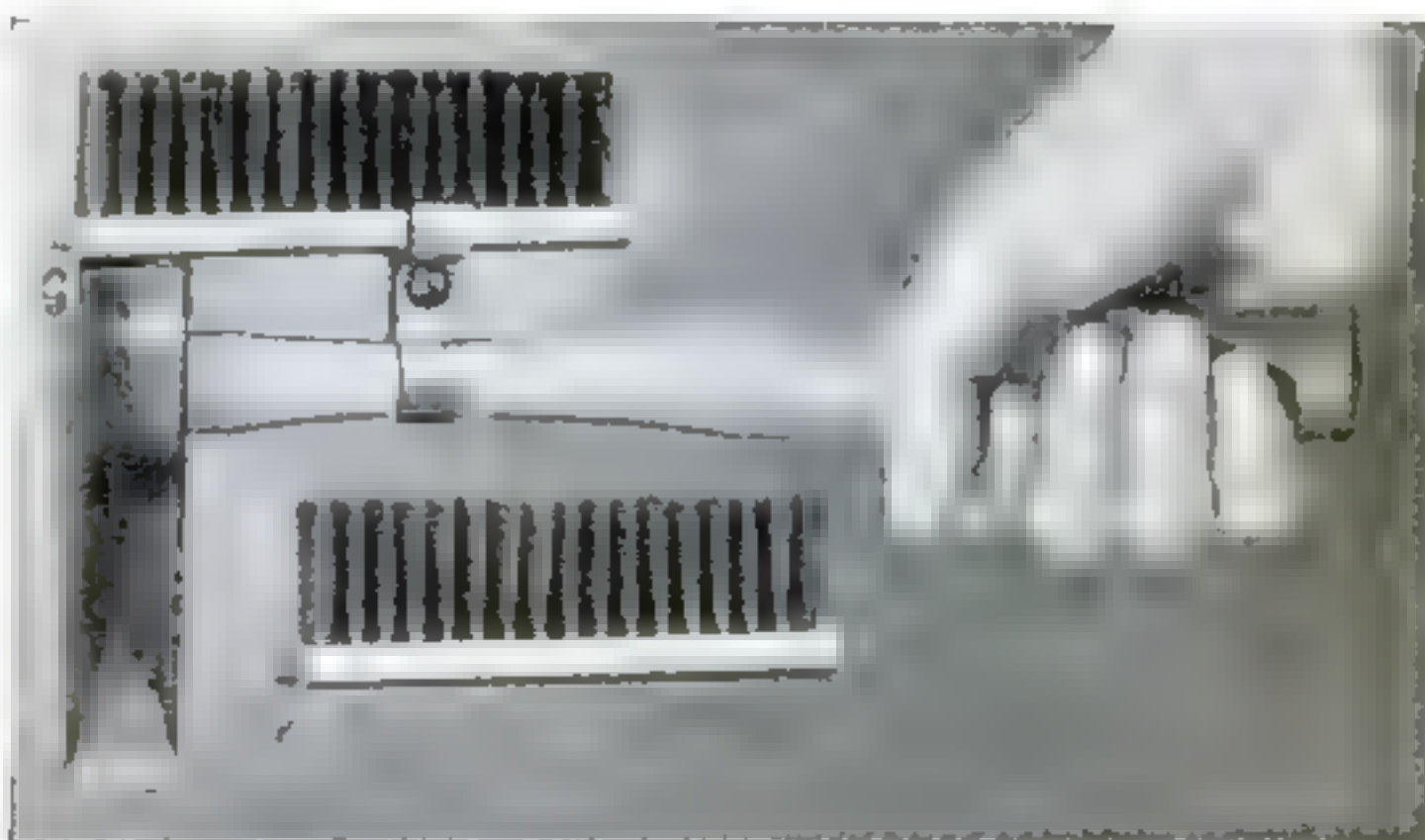


Aluminum Soft-Ball Bat

SIMILAR in weight and balance to regulation wooden bats used in soft-ball games, an aluminum bat now on the market has the added advantage of being practically unbreakable. In addition, the manufacturers claim the aluminum-alloy bat has a much longer life, cannot be damaged if left outdoors, and will not warp nor splinter.

Hammer Has Clip-On Brush

A NEW stoneworker's tool now available combines a chipping hammer with a wire cleaning brush, as shown below. Mounted on the hammer head by an easily operated clamp, the steel-bristle brush can be removed for replacement when worn out.



A screw and a clamp hold the cleaning brush in place



City Cabinetmaker Runs Sidewalk Boat Shop

ONLY a few blocks from the Empire State Building, on one of the busiest streets of New York City and a mile or so from the nearest water, an enterprising craftsman makes rowboats and sells them like groceries or newspapers at a sidewalk stand. With lofty buildings on all sides, with tens of thousands of persons a day passing in an endless stream, Eddy Faerber, proprietor of this strange business, makes the boats in his basement shop, and when a customer arrives, emerges to dicker with him on the sidewalk while traffic roars past. He has built and sold more than 5,000 rowboats at this one spot in the heart of America's biggest city.

Originally, Faerber was a cabinet-maker who spent his spare time in summer months rowing for fun and exercise. During a lull in work, one

spring, he constructed a twelve-foot skiff. The craft had such a trim appearance, he placed it on the sidewalk to attract attention to his cabinet shop. Instead of attracting just attention, it attracted a customer who paid twenty-two dollars for the boat. Faerber replaced his "advertisement" with another boat. From then on, throughout the summer, his



A Faerber boat meets the "Mercury"

Eddy Faerber working in the basement shop where he makes rowboats to sell at his sidewalk stand. At the right, with his helper he installs a stern seat



By GEORGE FENTON

rowboats sold almost as fast as they were displayed. Cabinet-making was relegated to the position of a part-time job and rowboat building became Faerber's main business.

While most of his sales are made to persons living in the vicinity of New York City, customers have bought boats for use as far away as Maine and Canada.

A few years ago, a Canadian lumberman, who was visiting relatives in New York City, stopped to look over Faerber's boats. He was searching for a sturdy, flat-bottomed craft in which to explore small streams far back in the Canadian wilderness. One of the models he saw at the "rowboat corner" filled the bill exactly. He bought it and shipped it 600 miles north to the starting point of his expedition. The next year, he called on Faerber again and reported that the "sidewalk" boat had stood up splendidly under hard usage.



When a customer appears, Faerber emerges in the open-air "show room"

Another time, the owner of a summer camp in Maine bought twelve boats all at one time. Before nightfall, he had them loaded on a truck and rolling north toward their destination. To take care of such emergencies, Faerber has a reserve supply of boats, piled up like saucers, in a back room of his shop. Even (Continued on page 214)



H. E. Moulds at work on a portrait made from burnt matches

Burnt-Match Portraits Made as Novel Hobby

MAKING portraits with burnt matches is the unusual spare-time hobby of H. E. Moulds, a hairdresser of Worthing, England. Building up the faces of his subjects by placing matches side by side, Moulds uses the burnt ends to provide the shading for hair and facial features. One of his unusual works of art is a picture of Prime Minister Neville Chamberlain. He is shown at the left putting the finishing touches on a match portrait of Winston Churchill, British statesman.

Lightning Not So Fast, New Speed Tests Show

"QUICK as lightning" used to mean simply as fast as anything you could imagine. Now J. M. Meek, University of California physicist, reports actual measurement of the speed of lightning. His figure: 22,000,000 miles an hour, or about 30,000 times the velocity of sound and one thirty-first the speed of light.

Lever Adjusts Mattress to User's Weight

PULLING a lever on the side of a novel spring mattress now on the market adjusts the springs to any desired degree of hardness. In the double-bed type illustrated below, two separate units, each working independently of the other, are installed on opposite sides of the bed at the head end. Thus two persons can enjoy individual sleeping comfort even though one is a heavyweight and the other of lighter proportions, since each can move a lever to adjust the spring on that side to the most comfortable ten-

sion for sleeping. The levers, which can be moved while lying in bed, operate mechanisms that increase or decrease the tension of the springs.



The lever on the side of the mattress controls the spring tension. Above, double-bed springs showing individual control



How a Diver Looks to the Fish

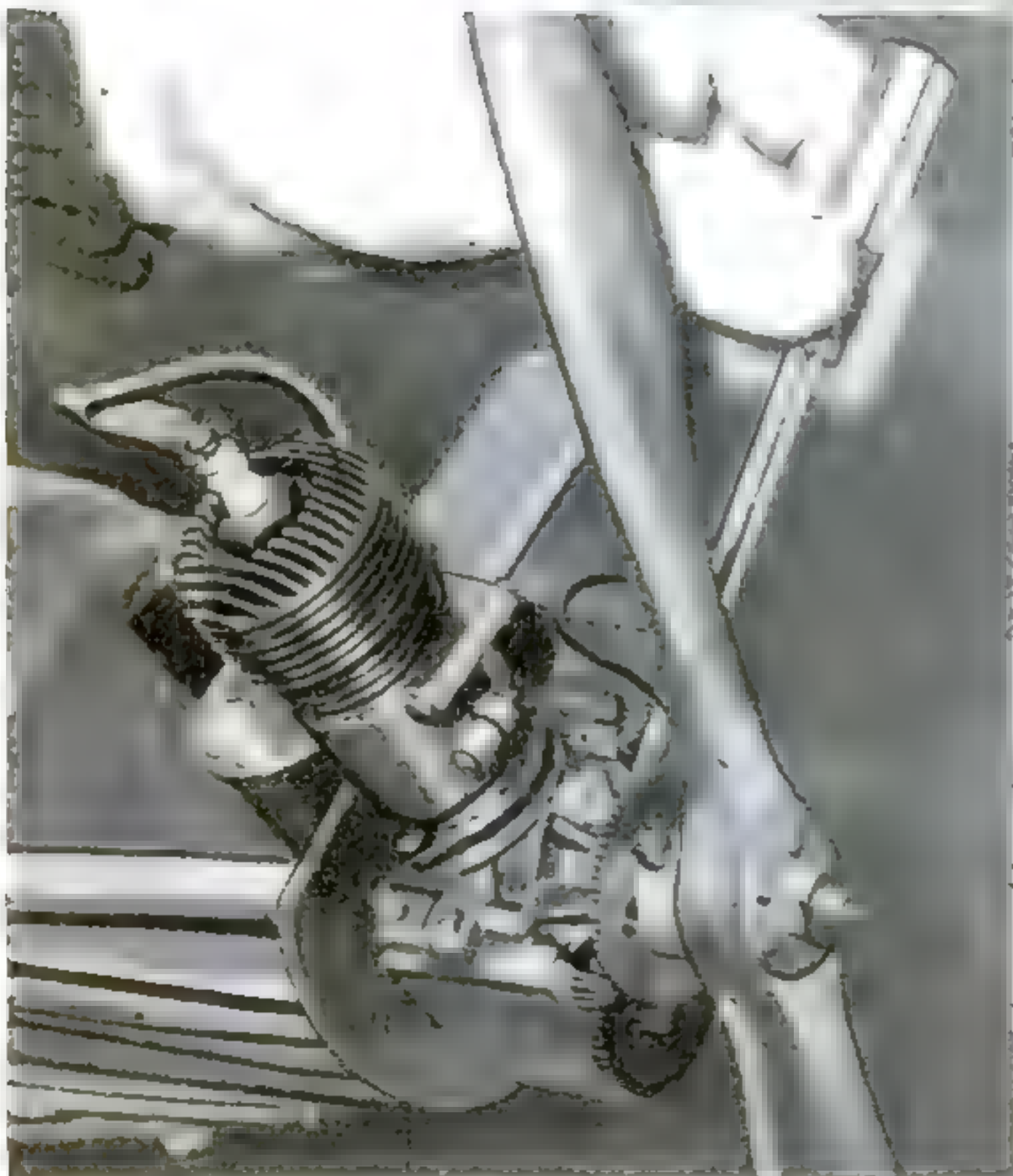
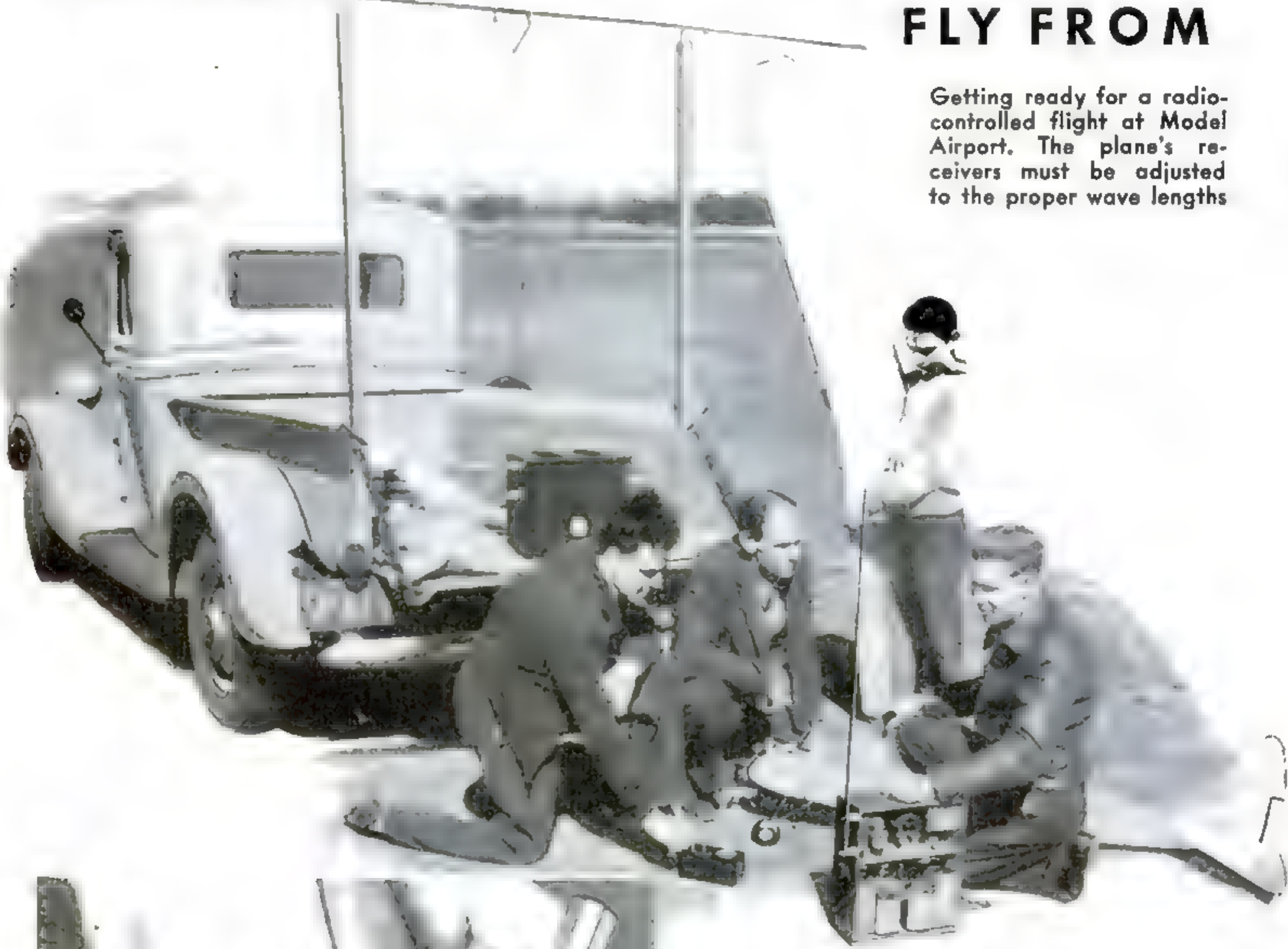
THROUGH an observation window built into a new swimming pool at Wellesley College, spectators can now study the underwater technique of expert swimmers and divers. A sample of what they see is shown by this remarkable photograph of a diving

girl, planing like a submarine ahead of a train of air bubbles. Reflection of light from the underside of the water's surface gives the curious illusion that the picture is upside down. Invert it, and the girl will appear to be skyrocketing out of the pool.

Radio-Controlled

FLY FROM

Getting ready for a radio-controlled flight at Model Airport. The plane's receivers must be adjusted to the proper wave lengths



Note the tiny remote-control electric motor and gear train that move the "throttle" on this plane's engine

By **ANDREW R. BOONE**

OVER "Model Airport," a 600-foot-square field near Los Angeles, Calif., a pilotless airplane banked gracefully into the wind, approached a little group of eager observers beside the runway, and, with its engine idling, glided in for a perfect three-point landing.

The observers were some of the 300 members of the Gas Model Airplane Association of Southern California who gather at Model Airport to fly their little planes. Statistically, the association represents only a few of the 3,000,000 Americans who annually invest nearly \$4,000,000 in strips of balsa wood, in silk, midget gasoline motors, and other paraphernalia that go into model airplanes. Yet, the pilotless plane that they watched was not "just another" of the countless models you might run across. It was completely radio-controlled, and of a type on which this

Model Planes

MINIATURE AIRPORT

organization has concentrated with astonishing success in recent months.

Built by Nathan R. Smith and Gregory Toben, of the association, it contained two tiny radio receivers, one to control the engine speed, the other to steer the plane. Two small transmitters on the ground sent up signals that controlled the gasoline-powered plane at the will of its "pilot."

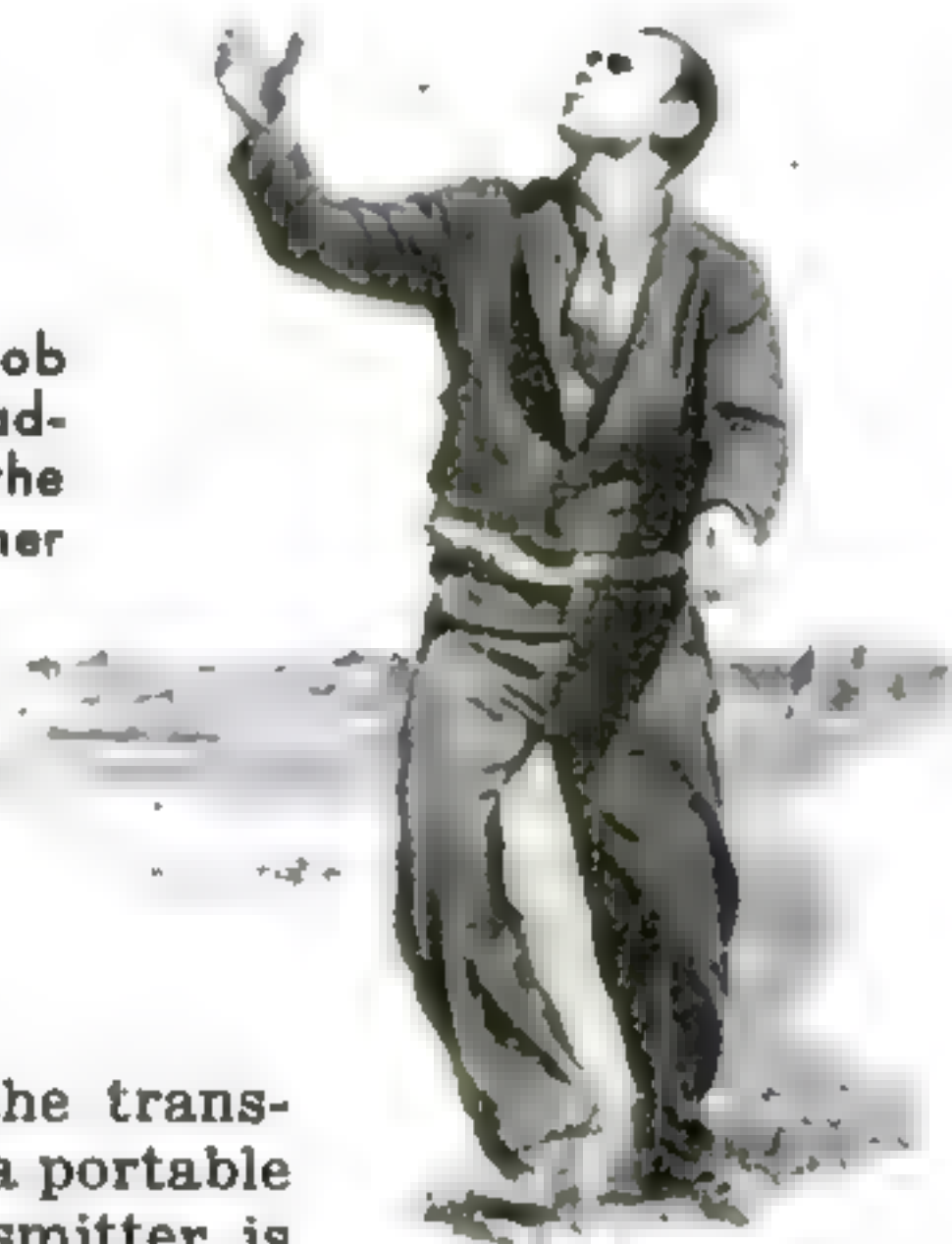
The model makers will explain to you that tiny electric motors in the model, geared at a ratio of 3,000 to one, work the controls smoothly and slowly. The little receivers use "thyatron" tubes, which actuate relays to permit current from batteries to flow to the control motors when—and only when—the receivers pick up the signals from the transmitter.

Each receiver with its relay weighs only five and a half ounces. Smith himself developed the two-ounce coils—each containing a mile of wire—that made the relays possible, and brought the full weight of the double-control radio equipment down to only two and a half pounds.

Before each flight, Smith and Toben mount two collapsible steel fishing rods across the tops of a pair of poles resting in sockets on the rear of a light truck. These rods serve as



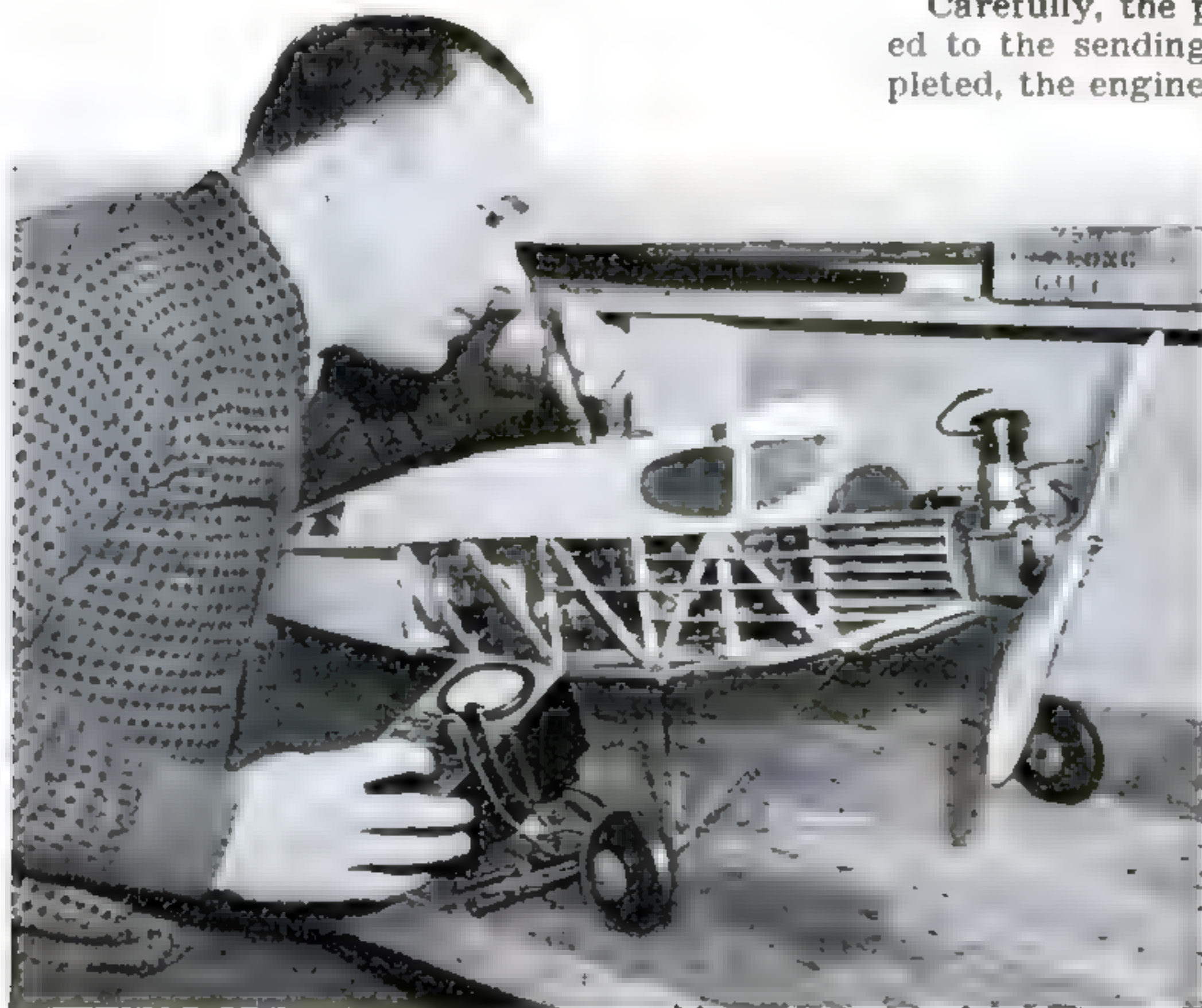
A radio-controlled job coming in for a deadstick landing with the assistance of its owner



the antenna for the transmitters housed in a portable cabinet. One transmitter is tuned to four and a half meters, the other to five meters.

Carefully, the plane's receivers are adjusted to the sending frequency. Checking completed, the engine is started. Smith touches a button on the transmitter. The rudder moves slowly. He depresses both buttons and releases one, and the motor begins to speed up. The plane rolls out to the runway and, as the rudder is returned to neutral, he presses one of the buttons again. The tiny ship swings into the wind, and with a mounting roar takes off in a steep climb.

Could you peer into



Nathan Smith checks the voltage of the batteries that power the receivers in his radio-operated plane

the fuselage during the flight, as the ground operator pushes the proper combination of buttons for speeding up the motor, you would see one of the relays close. Current would run to one of the control motors, which would turn a chain of tiny gears to advance the spark—the equivalent of the throttle in this two-cycle motor. A similar mechanism would turn the rudder right or left.

In due course, when you're weary of bending your neck to follow the flight, the right combination of buttons is pressed, and the plane glides down to a graceful landing. Since the tail wheel is attached to the rudder shaft, the operator steers the plane right back along the tiny runway to its starting point.

But Smith and Toben claim no extraordinary qualities for their handiwork. Each new plane is an "experimental job," as most any model builder will tell you. For example, William Atwood and Ira J. Hassad, also members of the California club, describe their newest creation as just that. It barely tips the scales at four and a half pounds when fueled with two ounces of a gas-and-oil mixture and loaded with radio equipment. Its single wing, weighing eleven ounces and held

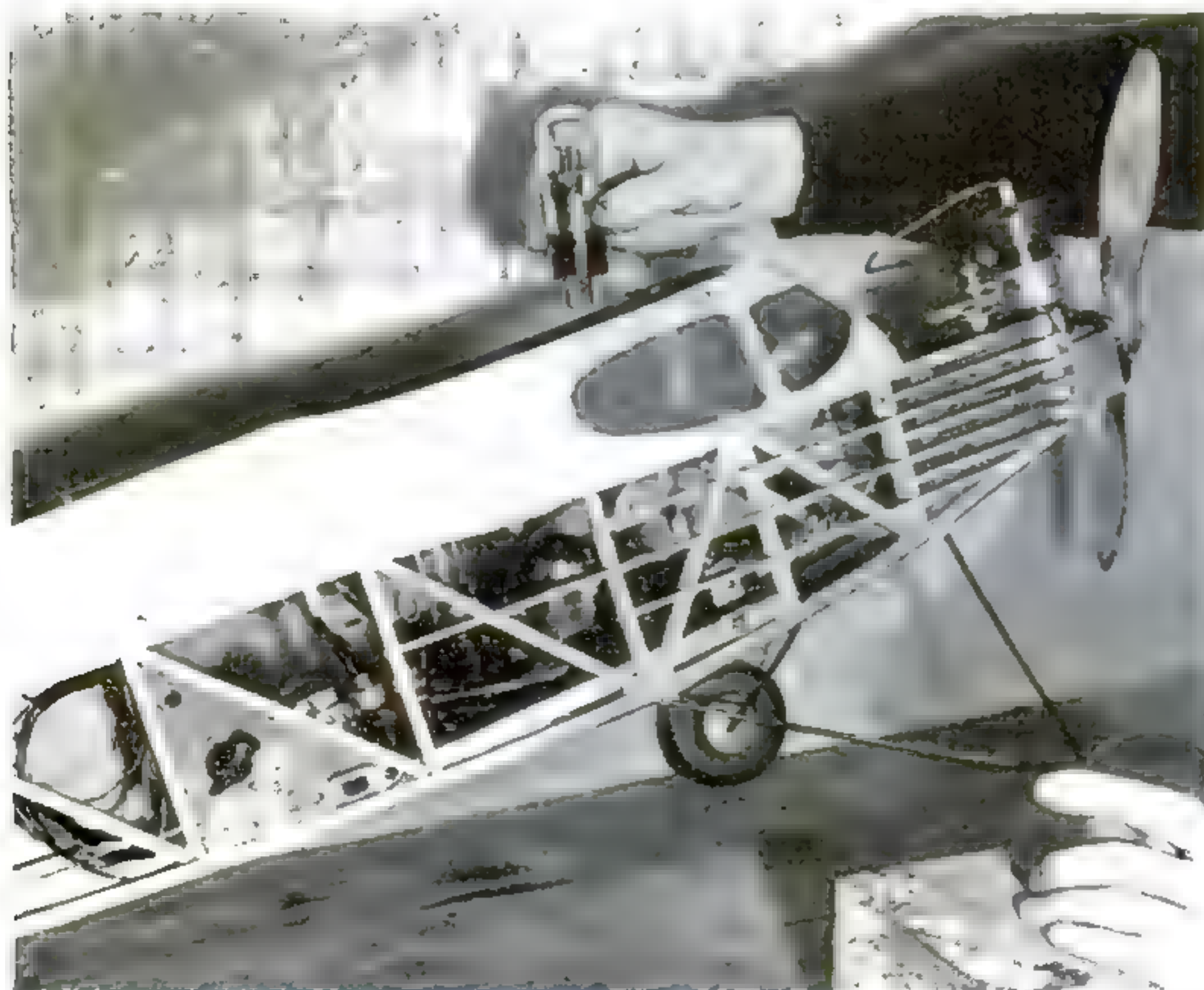
Four remote-control radio planes get set to take off from "Model Airport," near Los Angeles. Gasoline engines propel them all



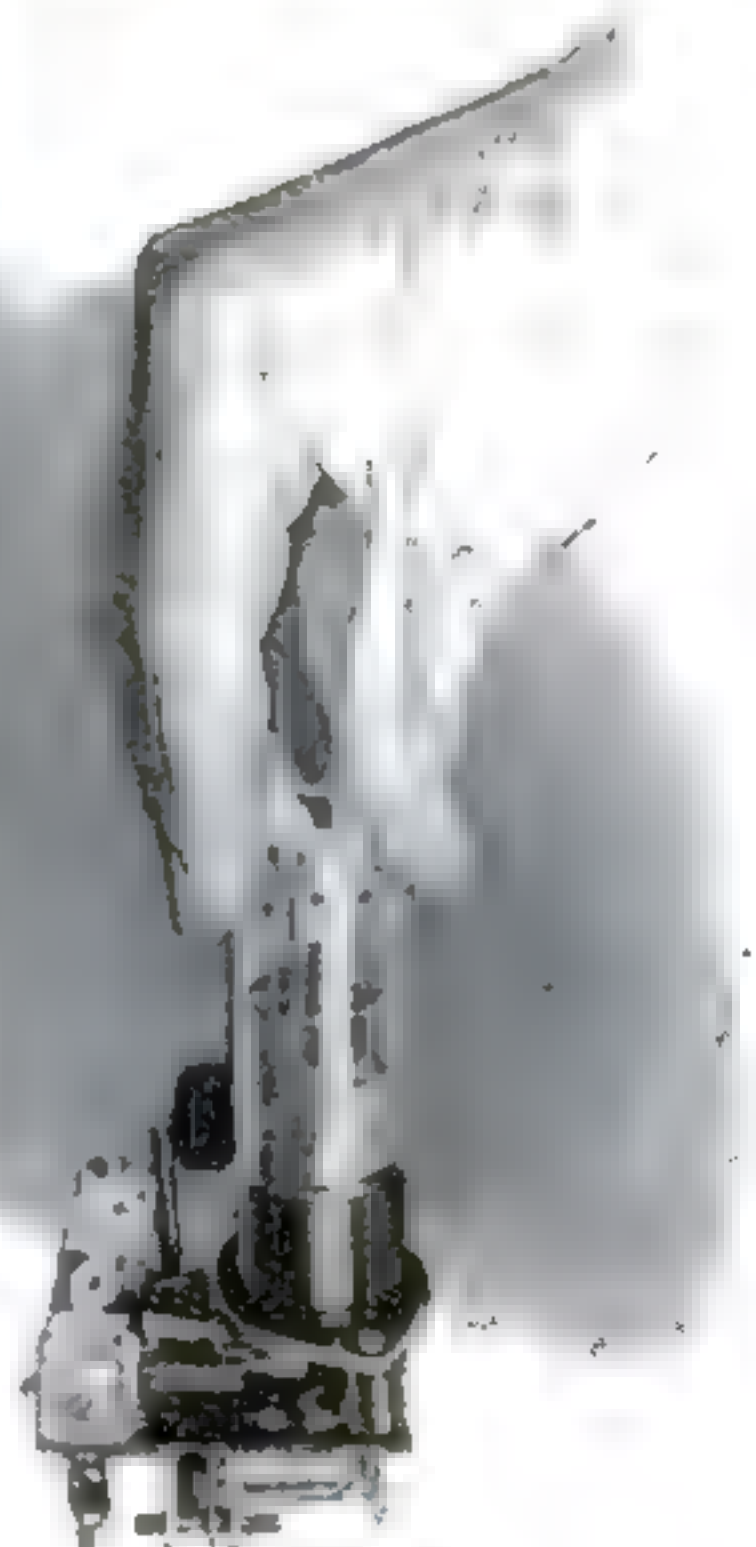
in place by rubber bands, stretches eight feet from tip to tip.

Near-by on the field, they are warming up their plane. It is known as a "single," having only one receiver, hooked up through a motor and worm drive to the rudder. Designed to maintain flight normally in a straight line, small springs hold its controls in neutral. To make it turn in flight, the radio-relay-operated rudder is moved to right or left. Its co-builders are working now on a more complicated model.

Lightness characterizes all the miniature planes. Stripped of its radio equipment and gasoline motor, the plane built by Atwood and Hassad weighs



How the radio equipment and motors actuating rudder and engine speed are mounted in the fuselage. At right, close-up of a receiver and (bottom) relay to set controls in motion



barely two pounds. Its one-seventh-horsepower motor keeps it aloft a half hour on two ounces of fuel. Irwin Ohlsson, another Model Airport experimenter, lashed two tomato cans into the narrow fuselage of his high-wing monoplane, filled them with gasoline, sent the ship aloft one morning, and watched it flash around the field for eight and a half hours before it glided to earth.

I asked several of the assembled model builders what they planned to build next. I was ready to agree that "single" and "double"

controls were fast approaching what they called perfection. To my astonishment, I learned that several of them are planning "triple" controls. With these, an operator on the ground will be able to govern the speed of the motor, turn the rudder, move the ailerons, and even depress and raise the elevators.

"And then," offered Toben, "we hope to drop miniature bombs by radio, operate running and landing lights, drop the landing gear for long-distance flights, and do almost anything at all."

"Pilot" Spins Tiny Dial To Guide Radio Plane



SIMPLY by twirling a telephone-type dial, Joseph Raspante, radio service man of Brooklyn, N. Y., puts a radio-controlled plane of his own design through its paces. Unlike other models that must first go through a cycle of control impulses, unless more than one transmitter and receiver are employed, his craft instantly obeys the dialed orders, "Stop," "Down," "Up," "Left," "Right," and "Neutral." Measuring ten feet in wing spread, the model may be controlled at distances up to two miles from the five-meter transmitter and six-foot-high aerial used.

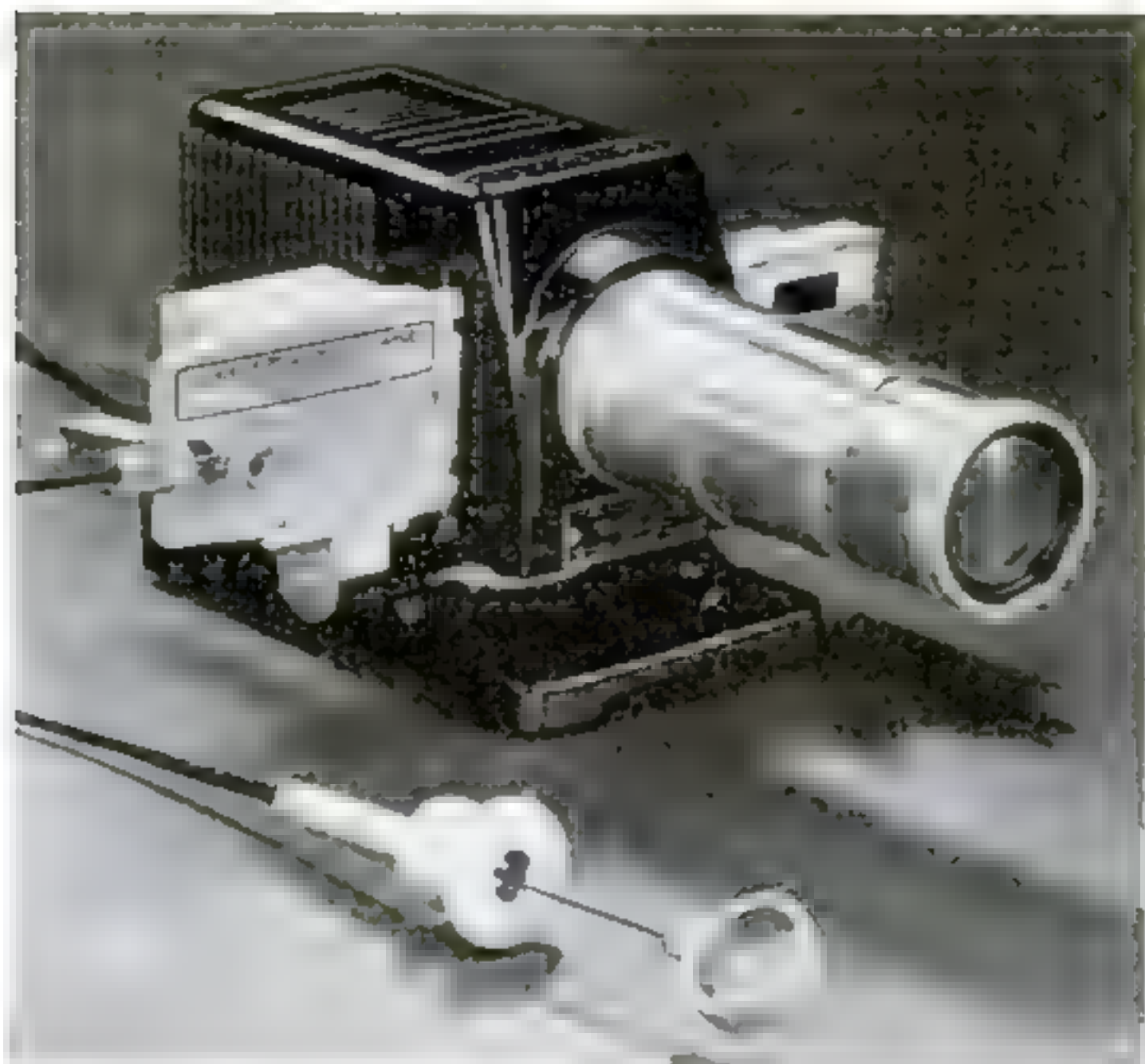


As the telephone-type dial on this transmitter is twirled, the plane instantly obeys any one of the six flying orders visible on the panel



Joseph Raspante and assistants put his homemade remote-control plane through its paces in a test flight

New Wrinkles for



"Strap-Watch" Camera Is Worn on the Wrist

LESS than an inch square, a tiny camera soon to appear on the market straps on the wrist like a watch. The camera boasts an F/4.5 lens containing four elements, operates at shutter speeds up to a hundredth of a second, and focuses on objects from one foot away to infinity. It carries a folding view finder and takes thirty-six pictures on a roll of film. A special enlarging kit permits "blowing up" the negatives, less than a quarter-inch square, to 600 diameters.



Worn like a wrist watch, the camera has an F/4.5 lens

Automatic Slide Changer

DESIGNED to fit a standard-make projector for thirty-five-millimeter transparencies, a new automatic slide changer handles fifty slides at once in any prearranged order. Once the magazine of the unit is loaded, the slides are changed simply by pressing a plunger at the end of a flexible, thirty-inch cable.

Camera Makes Finished Picture in Less Than Two Minutes

ANYONE can snap and develop a picture in less than two minutes with a camera just introduced. Besides taking the picture, the camera also develops it, turning out a finished paper print "while you wait." Up to fifty pictures are taken in one loading of the camera with a new, fast "direct-positive" paper. After an exposure is made in the usual way, a plunger is pulled, then a rubber bulb is squeezed to fill a built-in chamber with developing liquid. Squeezing another bulb rinses the blank—now a negative—which is then removed and quickly redeveloped in a daylight tank fastened to the side of the camera, to give a finished positive picture.

Loading the two-minute picture maker, at right. After exposure, bulbs are squeezed in turn to develop and rinse the film. Negative is redeveloped in tanks at one side

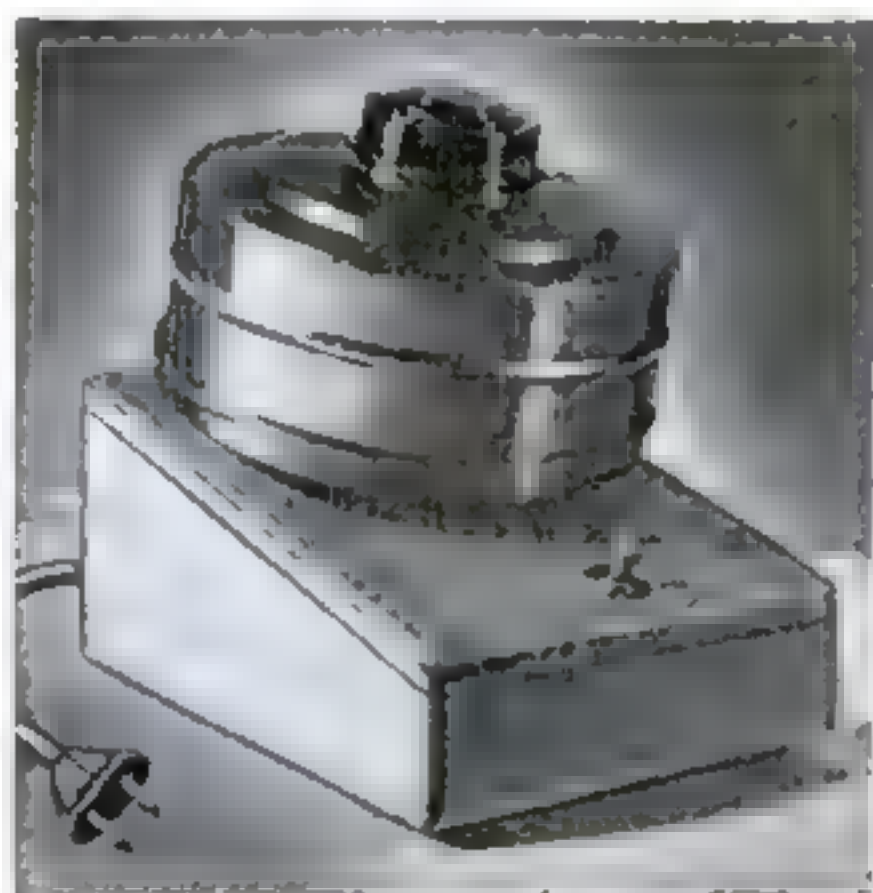
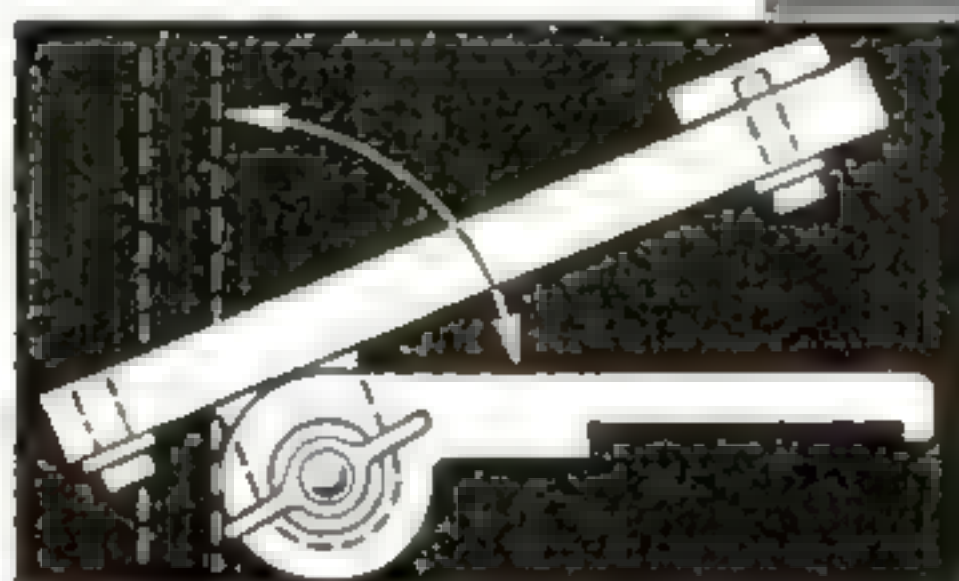


Amateur Photographers

"Swing-Top" for Tilt-Tops Tips Camera Sideways

TO ELIMINATE the necessity of removing your camera from the tilt-top head of a tripod in order to reset it on its side, or at any new angle on the axis of the lens, a handy "swing-top" has been developed that permits making this change instantly to any desired angle. The unit, illustrated at the right and in the drawing below, consists of two sturdy aluminum sections, hinged at one end. The lower section has a threaded hole to take the tilt-top-head thumbscrew, while the other is fitted with a thumb-screw to hold the camera in the position wanted.

Without removing a camera from its tripod, it can be quickly turned on its side with the "swing-top" unit illustrated at the right

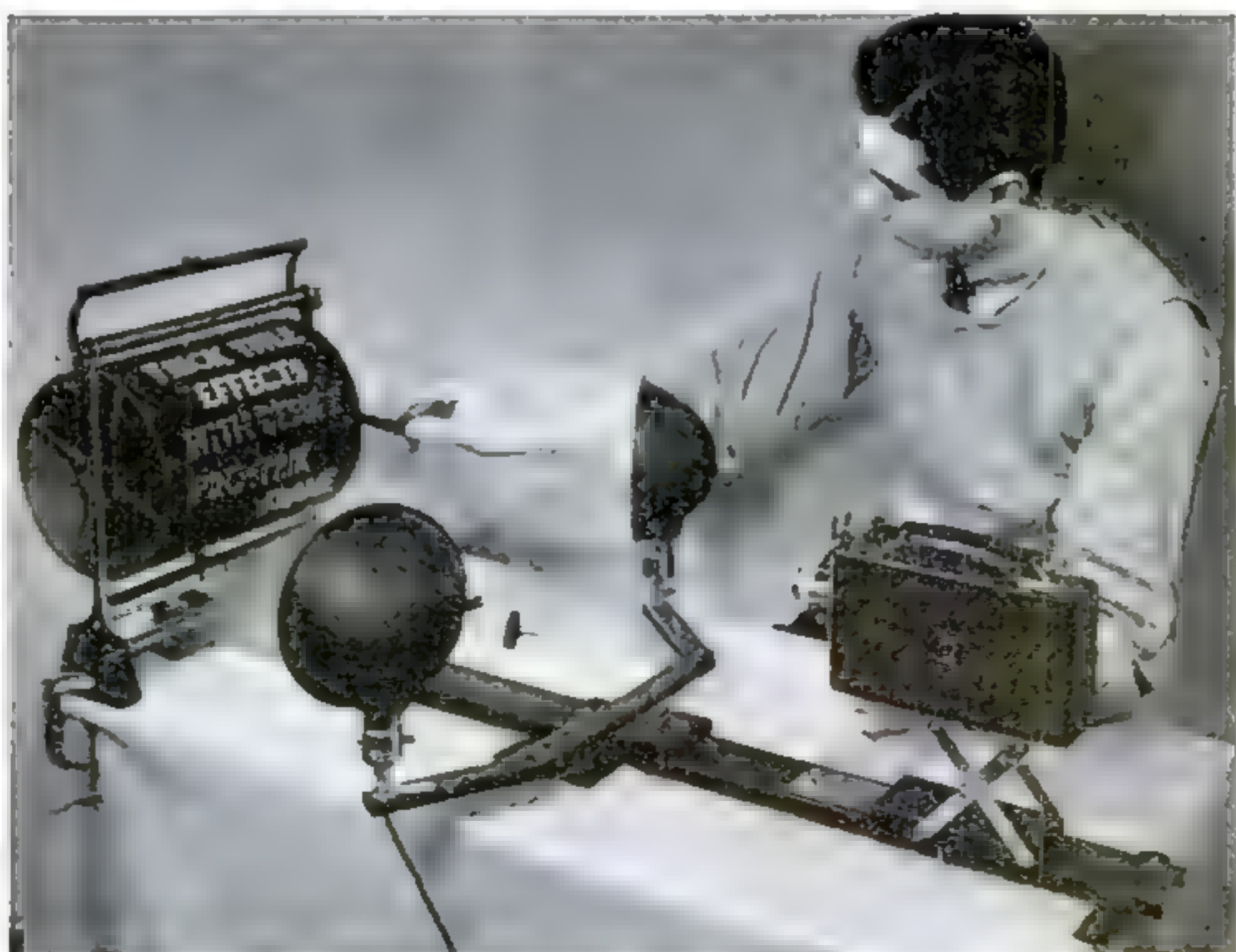


Film Agitator Set at an Angle Saves Developer

A NOVEL inclined turntable on which a developing tank is set revolves slowly to agitate the developing fluid so that it reaches all parts of a film, preventing bubbles and streaks on negatives. Because of the angle at which the tank rests, less developer is required, according to the manufacturer, and developing time is materially reduced. The device is pictured above.

Titler Gives Trick Movie Effects

All sorts of trick effects for movie titles can be worked out with the all-purpose titler shown below. Consisting of a sturdy frame in which various movable accessories may be mounted easily, the unit permits making titles of the revolving-drum or box variety, moving scrolls, "flop" and "turn-around" titles, and many others. A complete assortment of backgrounds appropriate for black-and-white and color movies is furnished, along with a selection of 150 stick-on title letters and figures.



The trick-effects titler set up for making a "turn-around" movie title

POPULAR SCIENCE

Question Bee

You don't have to be a walking encyclopedia to sift the true from the false in these posers. But don't be too confident of yourself until you've noted your answers and checked them on page 214



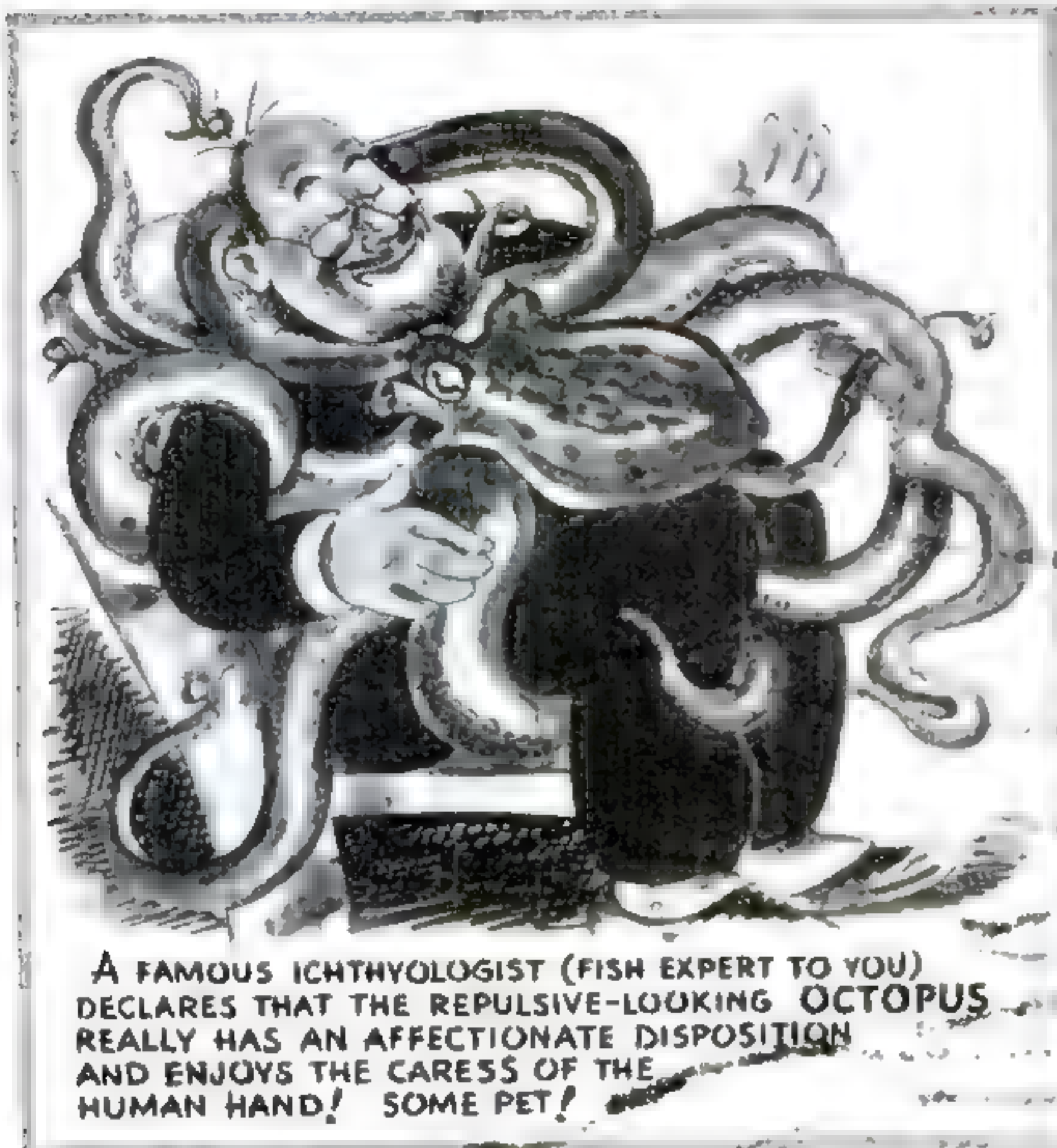
- 1 Pick off all of a flower's petals, and you will have removed the (a) corona (b) corolla (c) curriculum (d) cornucopia.
- 2 A meteorologist (a) reads meters (b) collects meteorites (c) predicts weather.
- 3 The kind of acid found in vinegar is called (a) acetic (b) formic (c) carbolic (d) muriatic.
- 4 You could use a bell crank to (a) play a tune on a carillon (b) start a balky car (c) transmit motion around a corner.
- 5 The world's highest peak is Mount Everest, in the (a) Alps (b) Pyrenees (c) Apennines (d) Himalayas (e) Andes.
- 6 Albinos lack (a) good sense (b) teeth (c) pigment (d) a tail.
- 7 America's first line of defense against invasion is (a) man power (b) naval power (c) hydroelectric power (d) solar power.
- 8 The Appian Way is (a) what people south of the equator see instead of the Milky Way (b) a method for solving quadratic equations (c) a famous Roman road.
- 9 A wire carrying an electric current is always surrounded by (a) a glow that is visible in the dark (b) a swarm of mosquitoes (c) an insulating material (d) a magnetic field.
- 10 Stamp collectors frequently identify different issues by their (a) hall marks (b) watermarks (c) plate marks (d) mint marks.

- 11 An archer carries his arrows in a (a) creel (b) quiver (c) scabbard (d) holster.
- 12 The "big trees" of California are (a) sequoias (b) oaks (c) sycamores (d) coconut palms.
- 13 If you had a cyclotron you could (a) pedal it to work (b) charge storage batteries (c) smash atoms (d) control the frequency of a radio broadcasting station.
- 14 The back of an animal is called its (a) obverse side (b) dorsal side (c) leeward side (d) starboard side.
- 15 Places marked "High" and "Low" on a weather map are areas of high and low (a) barometric pressure (b) wind velocity (c) temperature (d) altitude above sea level.
- 16 The part of an automobile that mixes air and fuel is the (a) crankcase (b) distributor (c) vacuum tank (d) carburetor.
- 17 Our sun is a fairly typical (a) comet (b) star (c) satellite (d) nebula (e) galaxy.
- 18 You could employ a polarimeter to (a) find whether you were at the north pole (b) test the polarity of electric wires (c) analyze sugar with the aid of polarized light.
- 19 An airplane pilot prefers to take off (a) into the wind (b) across the wind (c) with the wind.
- 20 You would need prompt treatment for snake venom if you were bitten by a (a) burgomaster (b) quartermaster (c) scoutmaster (d) bushmaster (e) toastmaster.

Money in Your Pocket

WOULD you like to earn money by submitting interesting, entertaining questions? We will pay a dollar for each one accepted for use. Submit as many entries as you like to the Question Bee Editor, POPULAR SCIENCE MONTHLY, 353 Fourth Avenue, New York City. No contributions will be returned.

Un-Natural History *By Gus Mager*



A FAMOUS ICHTHYOLOGIST (FISH EXPERT TO YOU) DECLARES THAT THE REPULSIVE-LOOKING OCTOPUS REALLY HAS AN AFFECTIONATE DISPOSITION AND ENJOYS THE CARESS OF THE HUMAN HAND! SOME PET!

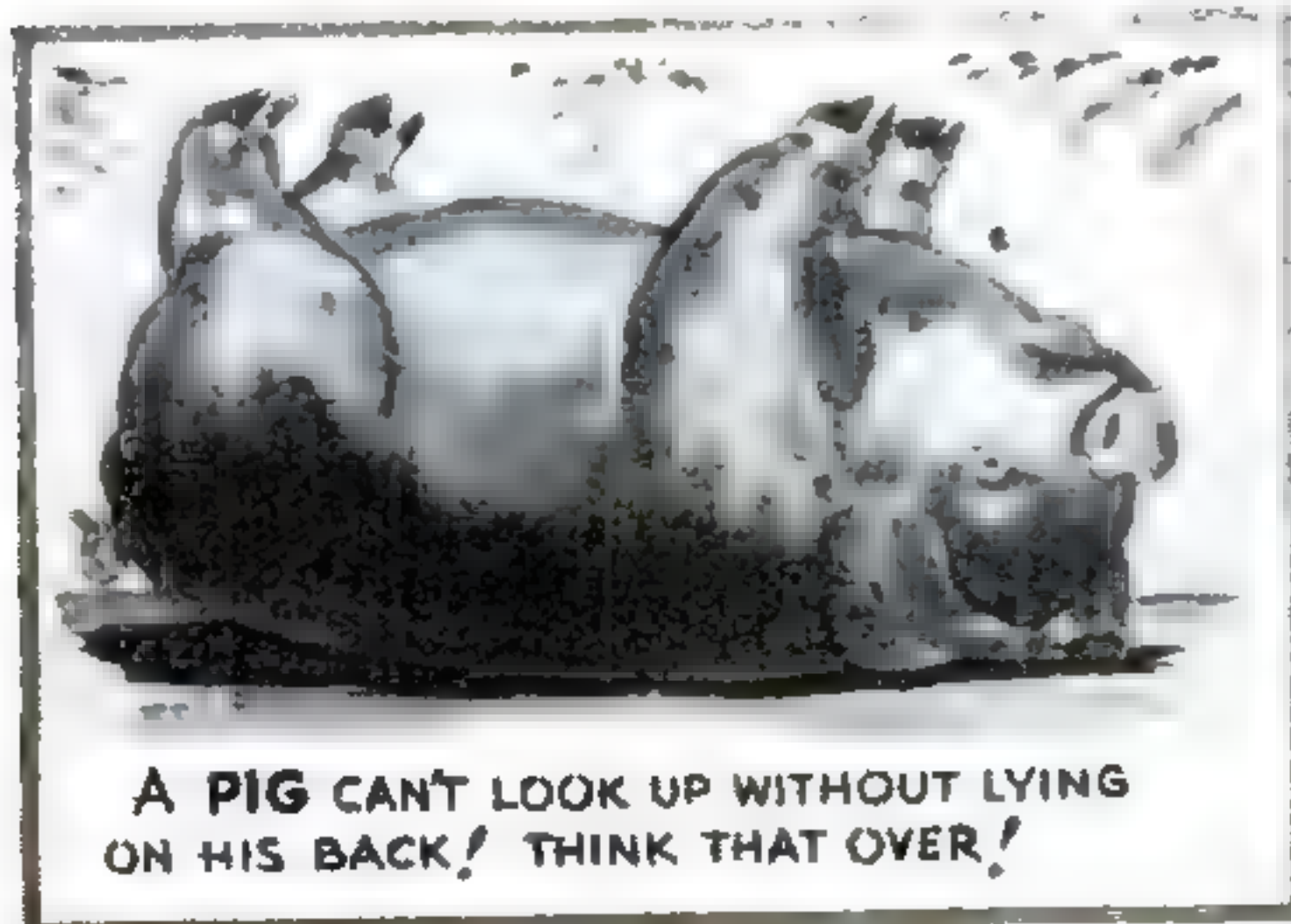
NATURE'S TOE-DANCER IS THE KLIPSPRINGER, A SMALL ANTELOPE OF THE MOUNTAINS OF AFRICA! IN ITS ROCKY HOME, IT CLIMBS, JUMPS, AND WALKS ON THE TIPS OF ITS TOES!



A SNAIL CAN CRAWL OVER THE KEEN EDGE OF THE SHARPEST RAZOR WITHOUT THE SLIGHTEST INJURY!



MILLIONS OF TINY GLOWWORMS FURNISH PERPETUAL ILLUMINATION IN THE CAVERNS OF GLOWWORM GROTTO, ONE OF THE "SIGHTS" OF NEW ZEALAND!



A PIG CAN'T LOOK UP WITHOUT LYING ON HIS BACK! THINK THAT OVER!



HUMMING BIRDS CAN FLY FORWARD, SIDEWARD, AND IN REVERSE-- BUT THEY CAN'T WALK ON THE GROUND! THEIR FEET ARE TOO WEAK AND DELICATE!



VACUUM-CLEANER DUST-BAG TRAY. The job of removing dust from a vacuum cleaner is made easier by a metal tray built into the bag. The tray lifts out for emptying, as seen above



DEODORIZER BURNS HANDY WICKS

Stuffy rooms are quickly deodorized with this novel device. A special wick is inserted between rollers, turned to the length desired, and ignited. As it smolders, it kills all odors

CLIP HOLDS SPOON. Clamped to the edge of a pot or pan, the coil-spring clip shown below holds a spoon where it is handy for stirring and eliminates the mess made by laying it on a table



HELPS FOR PREPARING YOUR VEGETABLES

Clipped onto the blade of a kitchen knife, the tool at left contains four narrow, sharp blades for slicing green beans. The vegetable chopper at the right has a spring-operated third blade, that holds food for chopping



the Housewife

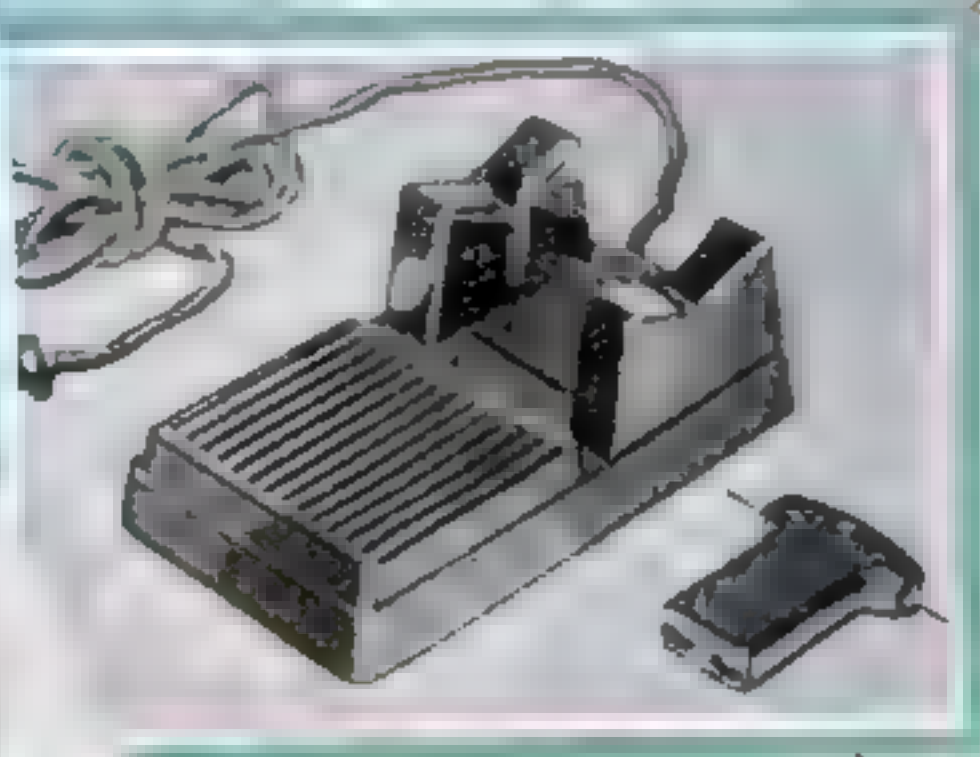


SOAPLESS DISHWASHING is made possible by new detergent tablets that contain no alkali. A single tablet will serve for several washings, being recovered from the water after use. The tablets are specially handy for campers and trailer travelers, and are effective in hard, soft, and even salt water

CORD ELIMINATOR FITS ANY ELECTRIC IRON

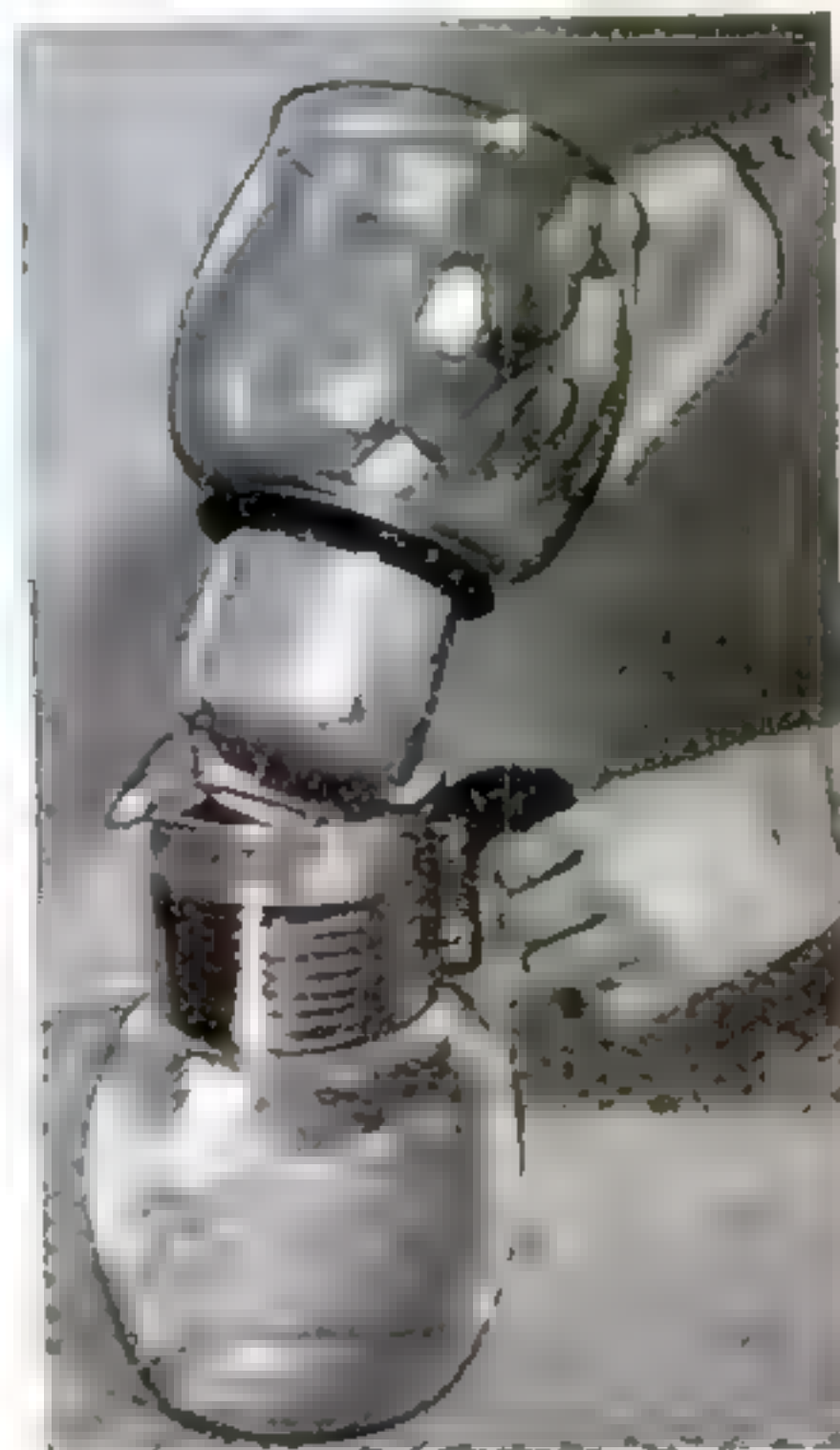
Designed for use with any electric iron, a new cord-eliminator stand keeps the iron at the desired temperature. A T-shaped connector, substituted for the regular plug, contacts two electrodes on the stand when the iron is upright

GLASS OVEN DOOR. Pressing a pedal opens the outer oven door of this electric stove, allowing food to be examined through a frameless inner door of heat-resisting glass



WATER FILTERED INTO PITCHER

To remove the taste of purifying chemicals, water is poured into the two-quart upper container of the unit at the right and passes through a bag of mineral filtering substance into a pitcher



Gus Wilson Misses

A MOVIE ACTOR SOLVES ONE FOR

GUS WILSON, driving his ancient and immaculate sedan back to the Model Garage after the Kiwanis luncheon meeting down at the Park House, whistled to himself softly and expressively when he caught sight of the car standing at the shop door. It was a long-hooded, low-slung roadster of an unusually expensive make—a job whose satiny finish and highly polished metal trimmings glistened almost blindingly in the afternoon sunshine, and which proclaimed “Important Money!” to every one within range.

The hood had been raised, and as Gus got out of his car he noticed that the big engine gleamed quite as dazzlingly as everything else about the plutocratic roadster. Cylinder heads, air cleaner, generator band, carburetor rods, and even the engine nuts had been chrome-plated!

Harry, the grease monkey, was listening to something that the car's driver was saying, and Gus noticed that his dirty face was red with badly suppressed excitement, and that his mouth was hanging half-open. “Yessir—yessir!” he said as Gus came close to them. “Yessir—here he is now!”

The driver was every bit as scintillating as his chrome-plated chariot. Taking him from the hoof upward, he wore rough-finished brown shoes that had the soft sheen of velvet, fawn-colored flannel trousers with knife-like creases, and a short-sleeved sport shirt of a delicate tint. His hands were incased in lemon-yellow chamois gloves. His hatless head was crowned by a smooth thatch of wavy black hair that had an oily sheen to it, his teeth shone whitely from under a small waxed mustache, and his eyes, as well as most of the upper part of his face, were protected by a pair of amber-lensed driving glasses. His face was almost as red as Harry's, and Gus didn't need to be endowed with second-sight to realize that he was hopping mad.

He looked Gus over disparagingly, and said: “Oh, so you're here—at last! I want this car fixed and I want it done quickly. I have a highly important appointment in the city this afternoon, and I'm an hour behind my schedule. So don't keep me waiting a moment longer than is absolutely necessary, my good man!”

Gus Wilson, who is a highly respected

member of his community and accustomed to living on terms of give-and-take equality with its leading citizens, never before had been addressed as “my good man.” It didn't take him more than a half second to realize that he didn't like it. He wasted plenty of time over filling and lighting his pipe. That done, he tossed a glance at the glistening roadster and demanded coldly: “Well, what's the matter with your circus wagon?”

Harry gasped. The customer glared—and then he grinned.

“It's lousy!” he said. “In strict confidence, it stinks! I paid plenty for it, and I've paid plenty more since I've had it. But I'm not squawking about that. What burns me up is that the damned thing . . .”

He had been gazing at his diamond-studded wrist watch while he talked. Now he broke off and stared at Gus. “I've got to 'phone!” he yelled. “Now—right away! Boy, show me your telephone!”

“**Y**ESSIR!” Harry said. “Right this way, mister!”

“I've seen that stuck-up sap somewhere before, I'll swear,” Gus said to himself as he watched them go into the office.

He was looking over the engine, thinking what a beautiful piece of machinery it was in spite of its chrome plating, when Harry came back.

“Gee!” the grease monkey said, breathlessly. “He's calling Dolores Damphier! I heard him tell the Ritz Hotel operator to get her for him. Gee! Just think of him coming in here!”

“What the devil are you talking about?” Gus snapped. “Who is this guy who's got you all overheated?”

“Who is he?” echoed Harry. “Do you mean to say that you didn't recognize him? Why, he's Montgomery Devoe. I knew him the second he drove up.”

“Yeah?” Gus said patiently. “Well, who's Montgomery Devoe?”

“Wha-what?” Harry stuttered. “You don't know who Montgomery Devoe is? Why, every one knows him! Don't you ever go to the movies? He was the star in ‘False Evidence,’ and in ‘Big Town Glamour,’ and in . . .”

By **MARTIN BUNN**

POPULAR SCIENCE

a Trick

THE VETERAN MECHANIC



Gus wasted plenty of time over lighting his pipe. "Well, what's the matter with your circus wagon?" he asked

"Oh," Gus said disgustedly. "That ham! You sound as if you were talking about Richard Mansfield or John Drew. So that's who our fancy customer is—I knew I'd seen him somewhere before. Well—so what? I'm not going to waste my time while he's blabbing to some movie dame. If he wants to talk to me about his car when he's finished 'phoning, tell him he'll find me in the shop."

Harry grinned widely. "You're sore because he called you 'my good man,'" he said. "You shouldn't mind that. I guess he gets to talking that way from those high-hat parts he always plays. Why, in his last picture . . ."

"Never mind about his last picture," Gus said. "You get back in the pit and finish greasing Mrs. Hanks's car!"

"Oh, all right," Harry said unwillingly. Then his grease-smeared face brightened as he asked: "Say, Gus, do you suppose he'd

give me his autograph if I asked him for it?"

"I'd say that the odds are a hundred to one that he'd give it to anyone who was sap enough to ask him for it," Gus growled. "But before you ask him, step into the office and tell Joe Clark for me not to accept your 'Mister' Devoe's autograph on a check in payment of his bill. I'll bet my shirt there's something phony about that bird!"

Montgomery Devoe's telephone conversation with the delectable Dolores Damphier was a lengthy one. A half hour later he came into the shop and approached the workbench, glanced at the array of tools on it, stripped off his chamois gloves, and picked up a vernier micrometer caliper that Gus had been using. "Tools!" he said dreamily. "Precision tools. I love 'em!"

"You do?" Gus said grumpily. "Well, now, that's something that I never would have guessed!"

The elegant Devoe put the caliper down as if it had burned his fingers. "Of course," he disclaimed hurriedly, "I'd be helpless if I had to use any tool. Utterly helpless! But now about that car of mine."

"Yes," Gus said. "What's the matter with it?"

"That," Devoe told him, "is something that no one has been able to discover. It ran well enough until a couple of weeks ago, when I allowed some fellow to talk me into having my engine chrome-plated. This is the first time that I've driven the car myself since then, but my chauffeur has been complaining that every time he gets up to thirty-five miles an hour, the engine begins to miss and labor, and then cuts out altogether. I drove from the city up to the Elm Valley Golf Club, and it did the same thing with me. Do you think you can locate the trouble—and fix it?"

"It might be in the distributor," Gus said. "Or it might be in the spark plugs, or in the coil, or in the condenser, or possibly in the fuel line. I guess I could find it and fix it for you all right, but it might take some little time. You told me that you are in a hurry, so I guess you had better take the job somewhere else."

"No, I'll leave it here," Devoe decided. "A fellow I was playing golf with this morning told me that you're tops as an automobile trouble-shooter. Get that boy of yours to call a cab for me, and I'll go back to the club and shoot another round. I'll be back here at half past five. You can have the car ready by then, can't you?"

"I'm not making any promise—not before I have a chance to check on the job," Gus said, rather ungraciously. "But if you want to leave it, I'll do my best for you."

Montgomery Devoe got Harry to take an oversize golf bag from his gleaming roadster, and departed in a cab. Gus went to work on the chrome-plated engine. He removed the distributor and cleaned the points. Then he timed and synchronized the distributor on his shop stroboscope. After that he tested out the coil, condenser, and spark plugs. Everything checked in the best of condition, and when he started the engine it ran smoothly. But when he speeded it up, it began to miss, and then cut out.

DECIDING that the trouble must be in the fuel line, Gus was about to start the job of cleaning it out when a motorist drove his six-year-old coupe into the shop and told his tale of woe. He was in a tearing hurry, too, but was polite about it, so Gus turned the job of cleaning and checking the fuel line on Devoe's roadster over to Harry, and went to work trying to find the cause of the fellow's grief.

When he had started his car that morning, he said, there had been a loud clattering noise that seemed to be somewhere near the clutch. He hadn't been able to find anything wrong, but ever since then his engine had been vibrating so violently that it shook the whole car.

Gus went out, got into the old car, and

stepped on the starter. The engine took off easily, and ran without any unusual noise, but the vibration was terrific.

He opened the hood and began to examine the starter. Under it he found a six-inch-long piece of metal which looked like part of a fan blade. "What's this?" he asked.

"Never saw it before," the car owner answered.

Gus examined the fan—a model with two heavy blades. One of the blades was broken off six inches from its end.

THERE'S your trouble," he said. "Your fan is of an exceptionally heavy type. The broken blade throws it out of balance, and that causes the vibration that's been shaking you up. I'll have to order you a new fan blade—we haven't got that model in stock. I'll have it tomorrow afternoon. Better not drive any more than you have to until then."

"Fuel line on this job of Mr. Devoe's is all right," Harry reported when Gus finally got back into the shop after performing several more "emergency" jobs for customers.

Gus glanced at the shop clock. It was half past five. And just then a taxi stopped at the door, and Devoe swaggered in.

"My car ready?" he demanded.

"Everything is all right but the fuel line," Gus told him. "I've had that cleaned out, but I've been too busy to check it. I'll do it now."

He got into the roadster, and stepped on the starter. The engine ran smoothly. He pressed down gently on the accelerator pedal. The engine picked up speed quickly—and then began to miss. And then it stopped!

"Same damn' thing!" yelled Devoe "What's the matter with all you fellows? You call yourselves mechanics, but . . ."

The hood still was up, and Devoe's eyes ran swiftly over the chrome-plated engine. Suddenly he leaped forward, and, careless of his chammois gloves, jerked the shiny cover off the air cleaner. The felt pad which should have been pressed snugly into the cover was resting loosely on the cleaner. "There's the trouble!" he exclaimed. "Step on her now!"

Gus stepped on her. The engine roared smoothly—and kept right on roaring when he pressed the pedal all the way down to the floor boards!

"That's one on me," Gus said slowly. "Whoever did that chrome-plating job was careless about fitting the felt back into the cover. Since then the loose felt has been acting as a governor. Up to thirty-five miles an hour it allowed the proper amount of air to enter the carburetor. But when the speed got up to thirty-five miles, the felt kept enough air from getting in, and the engine received too much (Continued on page 216)

THE HOME WORKSHOP



In This Issue... POTTER'S WHEEL • CAMERA KINKS
RADIO • MODELS • CRAFTWORK

THIS
INEXPENSIVE

Potter's Wheel

WILL START YOU ON AN
UNUSUALLY FASCINATING
AND PROFITABLE HOBBY



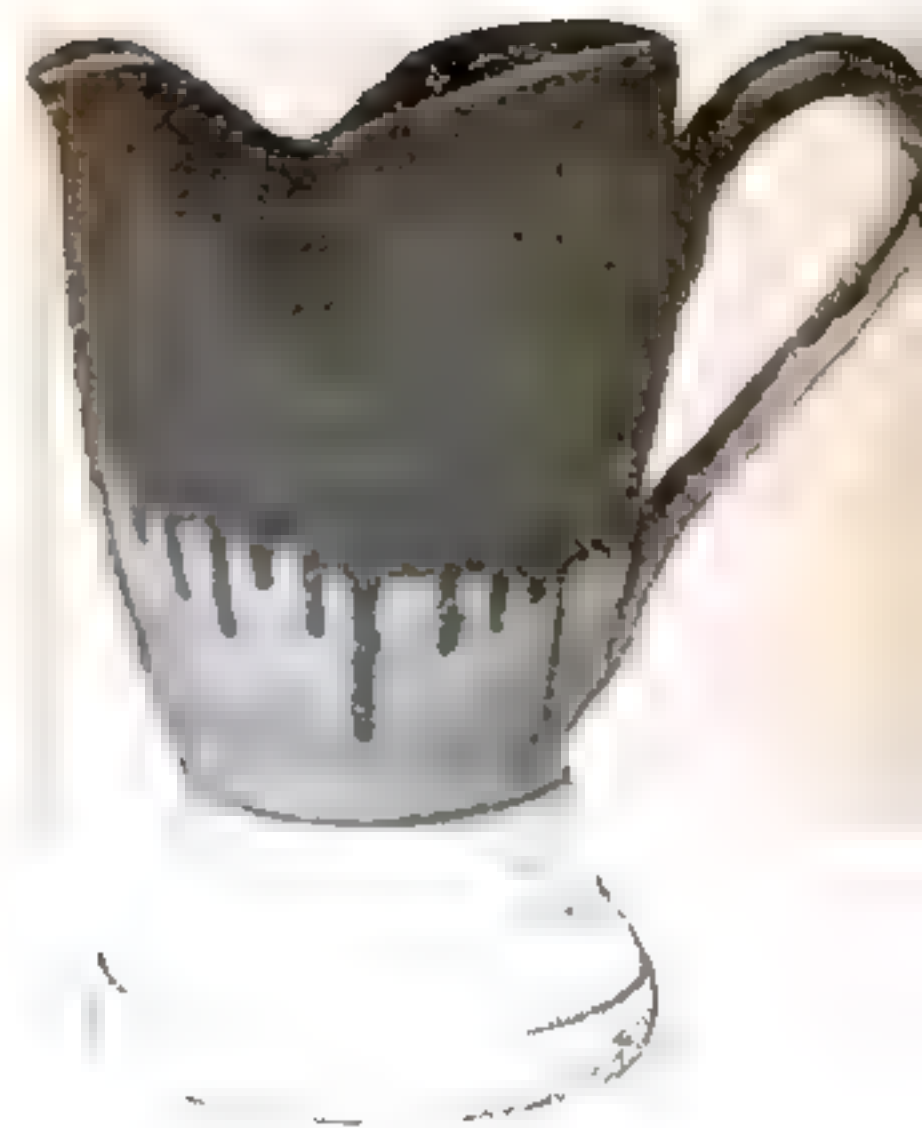
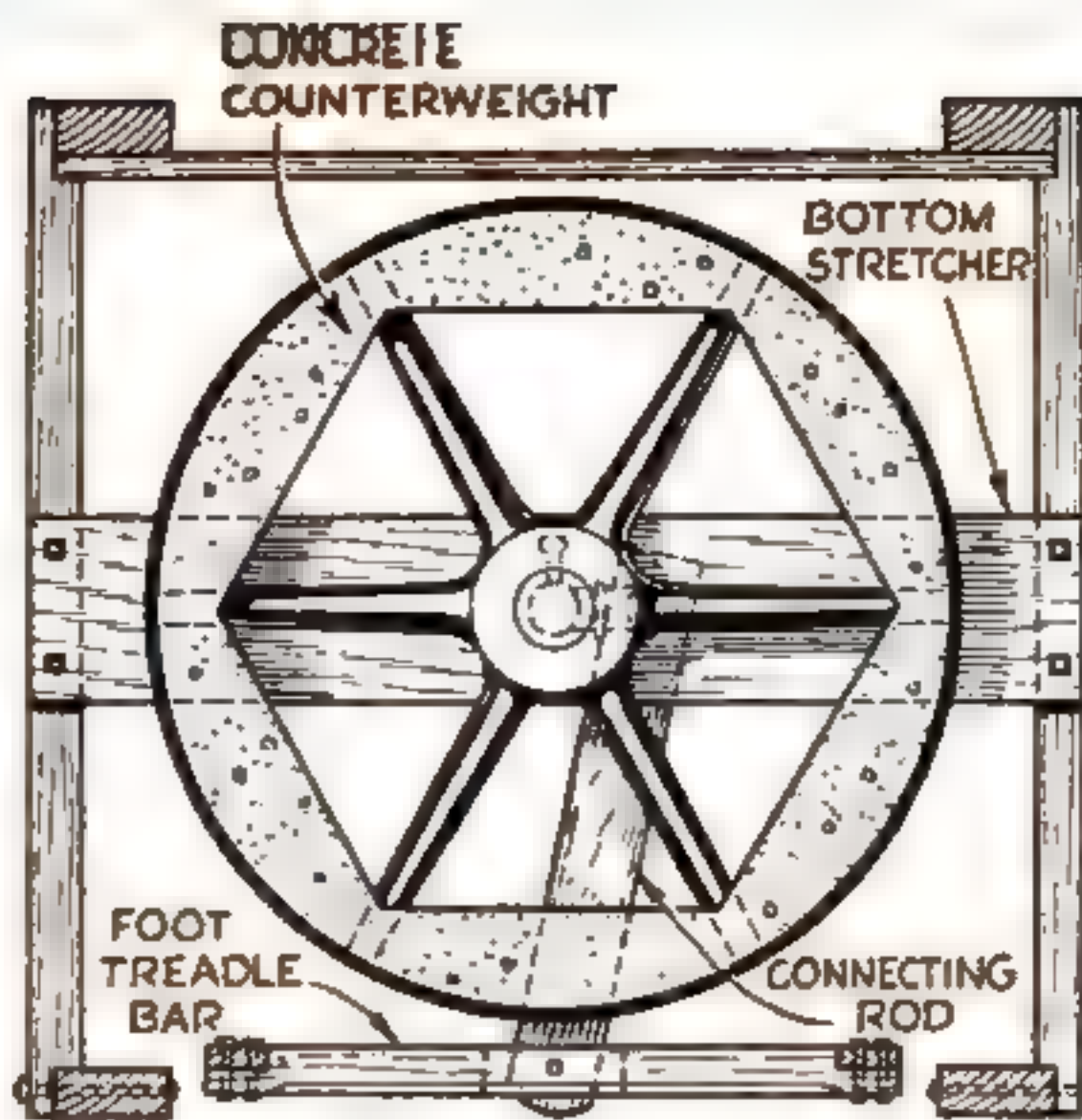
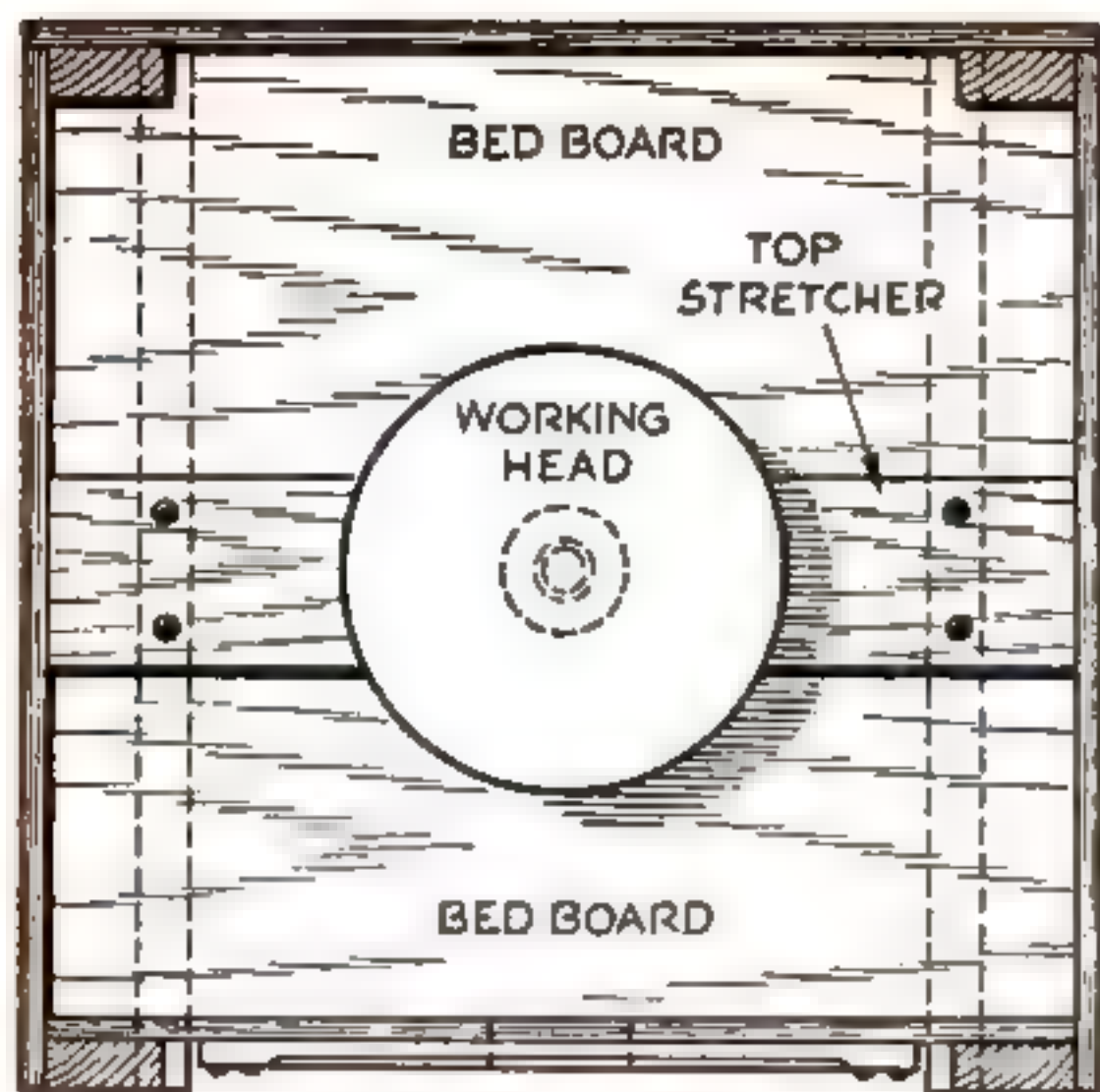
NO GREAT measure of technical skill is required to do pottery work, yet there is endless fascination in molding a lump of clay as it revolves upon the flying wheel. The potter experiences a thrill in feeling the clay give and spring magically into shape under the pressure of his fingers. It is, indeed, a craft that many amateurs could take up with pleasure and profit, especially as the principal tool—the potter's wheel—can be built at home.

The wheel illustrated is of an improved hanging-treadle type, with a short, nontiring stroke. Simple to construct, low in cost, and easy to operate, it has been thoroughly tried out by professional and amateur potters and has met with unqualified approval. The design permits its use not only for "throwing" or shaping the clay, but also for turning or finishing the leather-hard pieces with a lathe

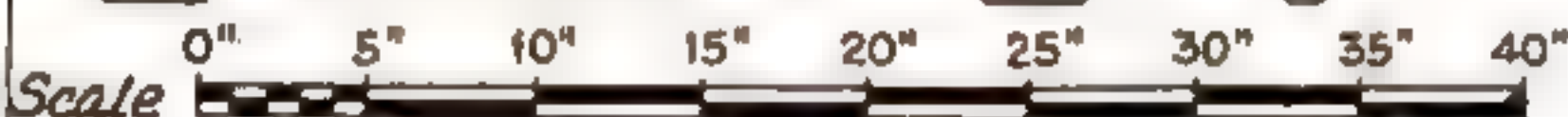
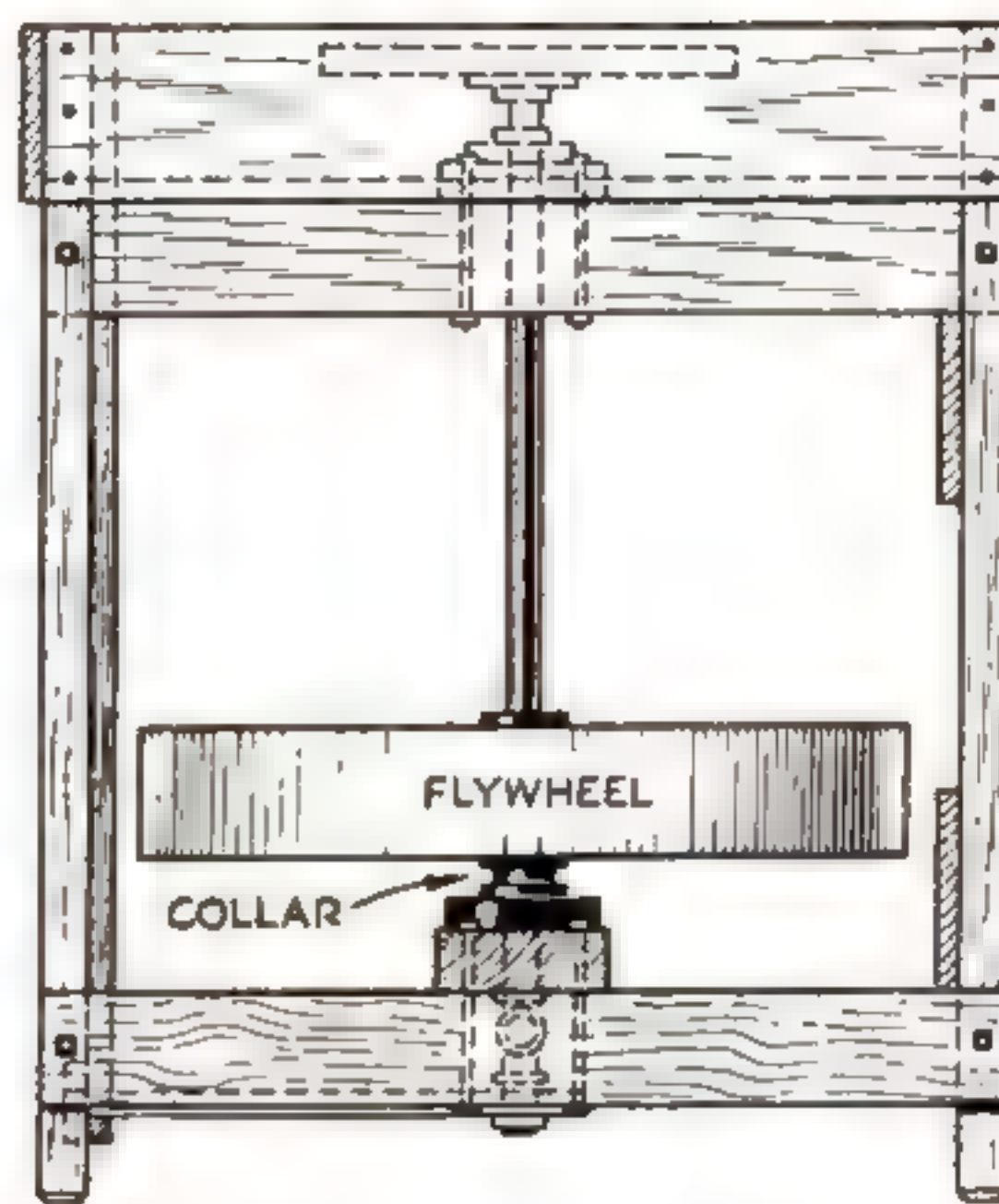
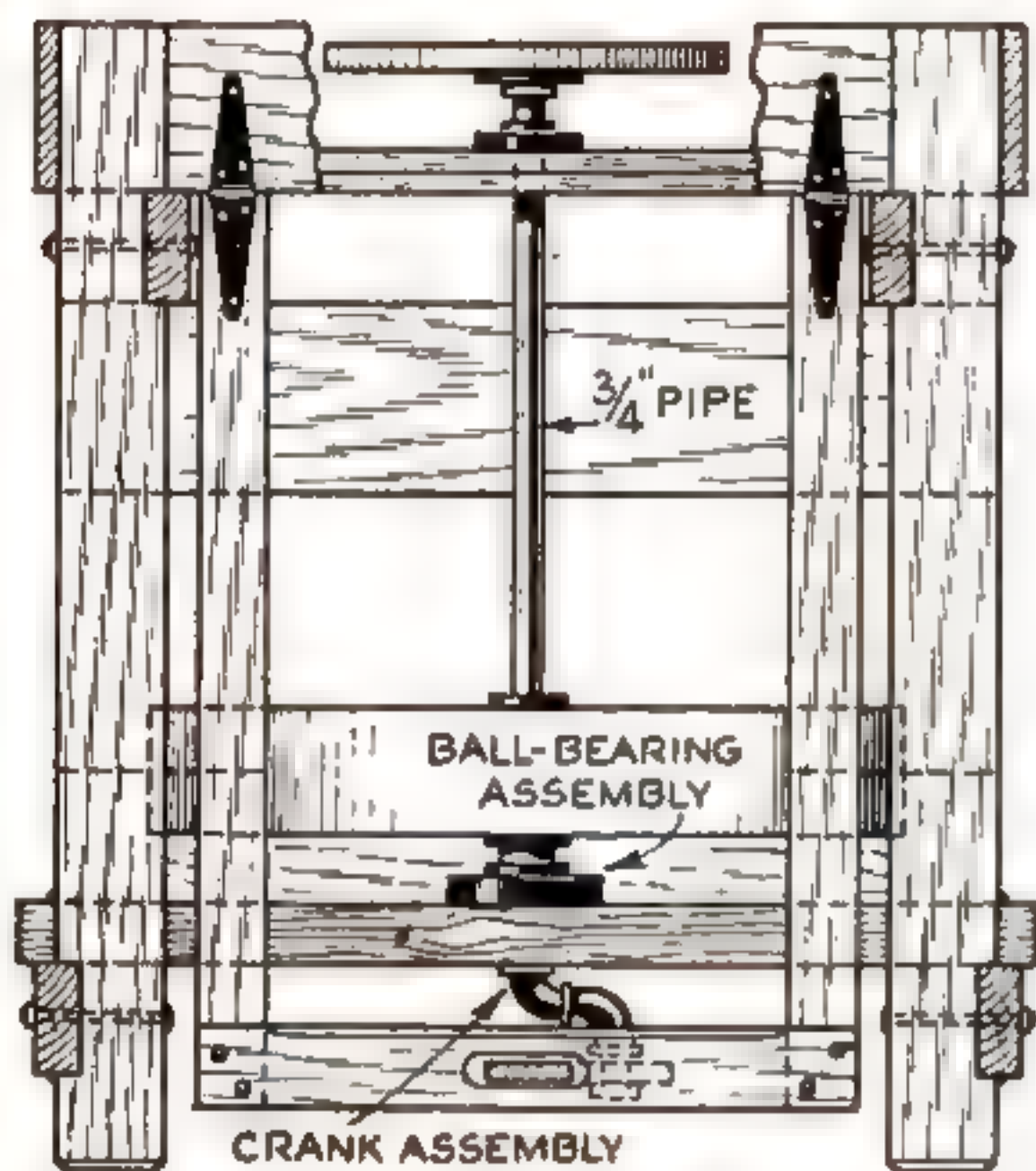


On this improved potter's wheel of hanging treadle type, the amateur finds it is easy to make pieces like those shown





Left the assembly drawings. One is a top view with the box bed removed to show the flywheel and connecting rod



tool, and banding or brush decorating the biscuit-fired ware. The motion of the wheel is contraclockwise (from right to left), and this tightens the working head on the shaft and also tightens the pipe-crank assembly.

The construction will take about two days' time, and the cost (varying somewhat according to the type of flywheel used) should not exceed \$7.50. The materials are itemized in the list on a following page.

Below are the three principal operations—throwing, turning leather-hard pieces with a metal tool, and banding with a brush. At right, the treadle moves only 5½\"/>



As the narrowest dimension of the frame is 30", it may be well to determine beforehand whether or not the complete wheel will pass through the door into the room where it is to be used. If the door is too narrow, plan to do the final assembling within the workroom.

Start work on the frame by making the four legs. Each has two cuts, one where the top rail is bolted to it, and one where the bottom rail is bolted. Clamp all four pieces together when marking the position of the cuts. Place the top and bottom rails on the legs to mark the width of the cuts. Saw down to the depth line, remove the waste wood with a chisel, and bore $\frac{3}{8}$ " holes to receive the bolts. Mark the position of the bolt holes in the top and bottom rails and the bolts to fasten on the top and bottom stretchers, and bore these holes. Now bolt the rails to the legs.

Bore $1\frac{1}{2}$ " holes for the pipe shaft and $\frac{3}{8}$ " holes for bolts in the top and bottom stretchers, as

How the flywheel, bearing, plywood housing, and crank shaft are mounted on the main shaft

shown, and bolt these members in place. Screw the two crosspieces or ribbands to the back legs. Next screw the two pieces that form the box bottom or bed to the upper face of the top rails, fitting them snugly against the top stretcher and scribing them around the tops of the legs. Screw on the sides of the bed. This completes the framework.

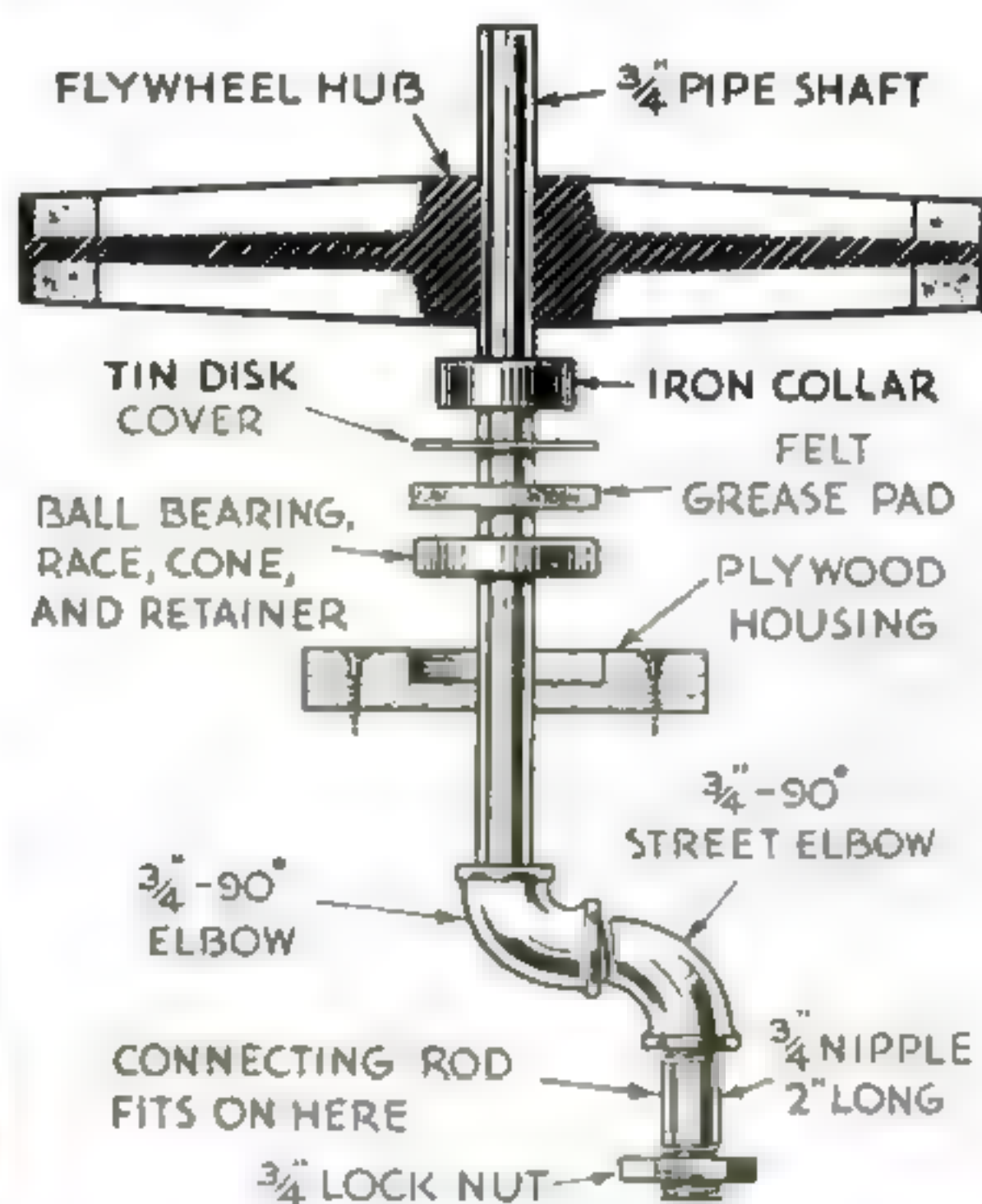
Make the wooden treadle and hang it in the position shown with two strap hinges. Prepare the wooden connecting rod, but bore only the larger hole—the one to receive the crankshaft—at this time, and set aside for the final assembly.

Next assemble the metal parts. If a light pulley of the set-screw type is to be used, it will be necessary to cast concrete around the outer edge, as was done with this one, in



If a comparatively light wheel or pulley is used, it can be given weight by fitting a form inside the rim and pouring in concrete

The flywheel weighs about 100 lb. with the concrete rim. Any heavy wheel from 18" to 24" in diameter will do



LIST OF MATERIALS

No. Pc.	Description	T.	W.	L.
4	Legs	1½	3½	36½
4	Rails	1½	3½	30
1	Top stretcher	1½	5½	30
1	Bottom stretcher	2	5½	32½
2	Ribbands	¾	6	30
3	Front and sides of box	¾	5½	30
1	Back of box	¾	5½	31½
1	Bottom of box	¾	10	30
1	Bottom of box	¾	12	30
2	Treadle hangers	¾	2¼	28¾
1	Treadle foot bar	1½	2½	21
1	Connecting rod	¾	2¾	17
1	Working head, 5-ply	¾	13 diameter	
1	Ball-bearing housing, 5-ply	¾	5 diameter	

NOTE: Dimensions are given in inches and are finished sizes. Soft wood, such as pine or Douglas fir, may be used for all parts except the connecting rod, which should be of oak or other hard wood.

MISCELLANEOUS

- 1 pr. 8" light steel strap hinges with ¾" wood screws.
- Carriage bolts: 4—5" by ¾"; 8—6" by ¾"; 4—2" by ¼"; 1—3" by ¾".
- Flathead bright wood screws: 36—1¼" No. 8; 8—¾" No. 14.
- 1 pc. ¾" black iron pipe 28" long, threaded both ends, for shaft.
- 1 complete ball bearing to fit pipe shaft.
- 2—¾" x 3½" pipe floor flanges. One should be reamed to form a guide for the shaft. The other is to fasten the working head to the top of the shaft.
- 1—¾" flat band, straight 90-deg. pipe elbow.
- 1—¾" flat band, street elbow, 90 deg.
- 1—¾" by 2" pipe nipple.
- 1—¾" pipe lock nut.

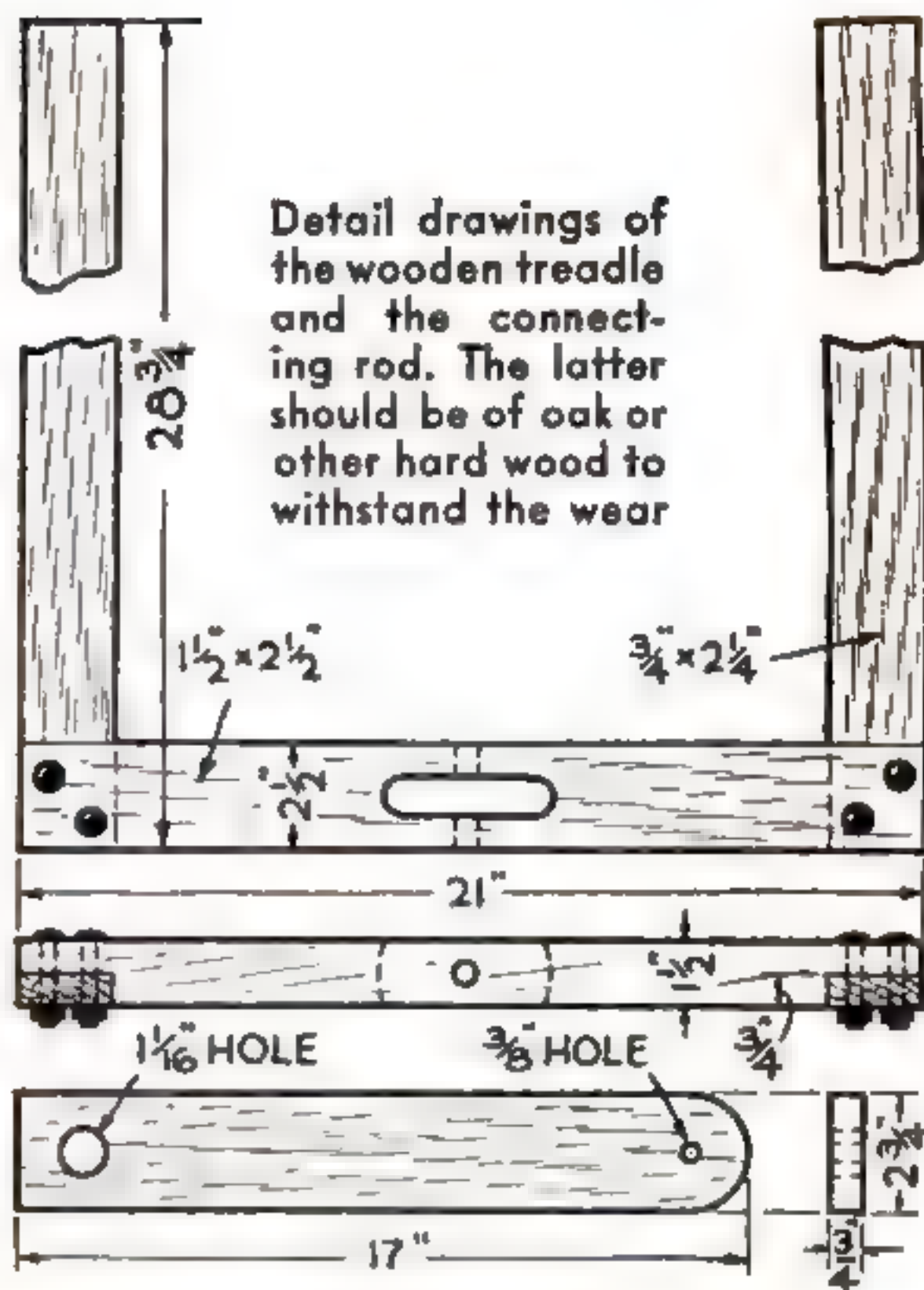
NOTE: All pipe fittings are ordinary black iron.

order to provide sufficient weight. Small strips of wood fitted around the spokes will make the inside form, and the inside face or rim of the pulley will provide the outside form. Use a concrete mixture consisting of one part Portland cement, two parts clean, sharp sand, and three parts gravel or crushed stone with a maximum size of ¼".

The wheel used in this instance has a 4" face, and with the concrete rim weighs about 100 lb. Either an old flywheel taken from a gas engine, or an old automobile or farm implement wheel weighted with concrete and provided with a set screw or two for locking it against the pipe shaft, is satisfactory. The wheel in the model shown happened to have a slight flaw in the hub and was purchased secondhand for 75 cents. The maximum diameter for the flywheel is 24". An 18" wheel, if heavy enough, will do equally well.

The wheel shaft is a piece of ¾" black iron pipe, threaded at each end. The outside diameter of the pipe will vary from about 1 1/16" to slightly over 1 ½", so obtain a wheel bored to fit the size pipe you use; or if the hole is somewhat larger, provide a metal shim to make a tight fit.

When selecting a ball bearing, keep the size of the pipe shaft in mind and get one of



Detail drawings of the wooden treadle and the connecting rod. The latter should be of oak or other hard wood to withstand the wear



A ¾" floor flange is screwed under the working head. The other flange is reamed to fit the shaft

the actual size or only slightly larger. The bearing used in the wheel illustrated cost 25 cents secondhand at an auto-wrecking yard. A good bearing may also be obtained at almost any garage or machine shop.

Bore a hole in a 5" disk of ¾" five-ply board to receive the ball bearing and shaft, being particular to see that the parts revolve freely. Attach this wooden housing with four screws in position directly over the hole in the bottom stretcher. Set the flywheel directly on top of the ball bearing in such position that the holes are all in alignment.

If the hub of the wheel does not fit the ball bearing, a metal collar may have to be placed between the wheel hub and the bearing. Lower the pipe shaft through the hole in the top stretcher, pass it through the wheel hub and

ball bearing, and allow it to project $\frac{3}{4}$ " below the lower face of the bottom stretcher. When in this position, lock the flywheel tightly in place by tightening the set screw or screws in the hub.

Screw on the pipe elbows that form the crank, and tighten them and the short pipe nipple (crankshaft) with a pipe wrench. Next, attach the pipe floor-flange guide, through which the top of the pipe shaft works, to the upper face of the top stretcher. Adjust the position by observing the motion of the shaft before finally screwing it in place.

Slip the connecting rod through the slot in the treadle foot bar and up over the nipple screwed into the street ell, and hold it in place with the lock nut screwed up loosely. Next, find the exact place to drill the hole to receive the bolt in the foot bar, and as there is more or less variation in different pipe fittings, this must be worked out in actual operation. Turn the flywheel so that the crank is parallel to the bottom stretcher. This is the halfway position of the crank stroke. With the treadle exactly plumb with the front legs, insert an awl or sharp nail through the hole in the upper face of the foot bar and force it slightly into the connecting rod so that it cannot easily slip out.

Keeping Dust from Lens of a Folding Camera

DUST is likely to settle on the lens of a camera even when it is folded and put away between camera expeditions. To remove the dust requires considerable care, so it is better to prevent it from reaching the lens. This can be done by cementing a piece of velvet or similar material to the camera bed so that it acts as a cover for the lens while the camera is closed.—GEORGE S. GREENE.



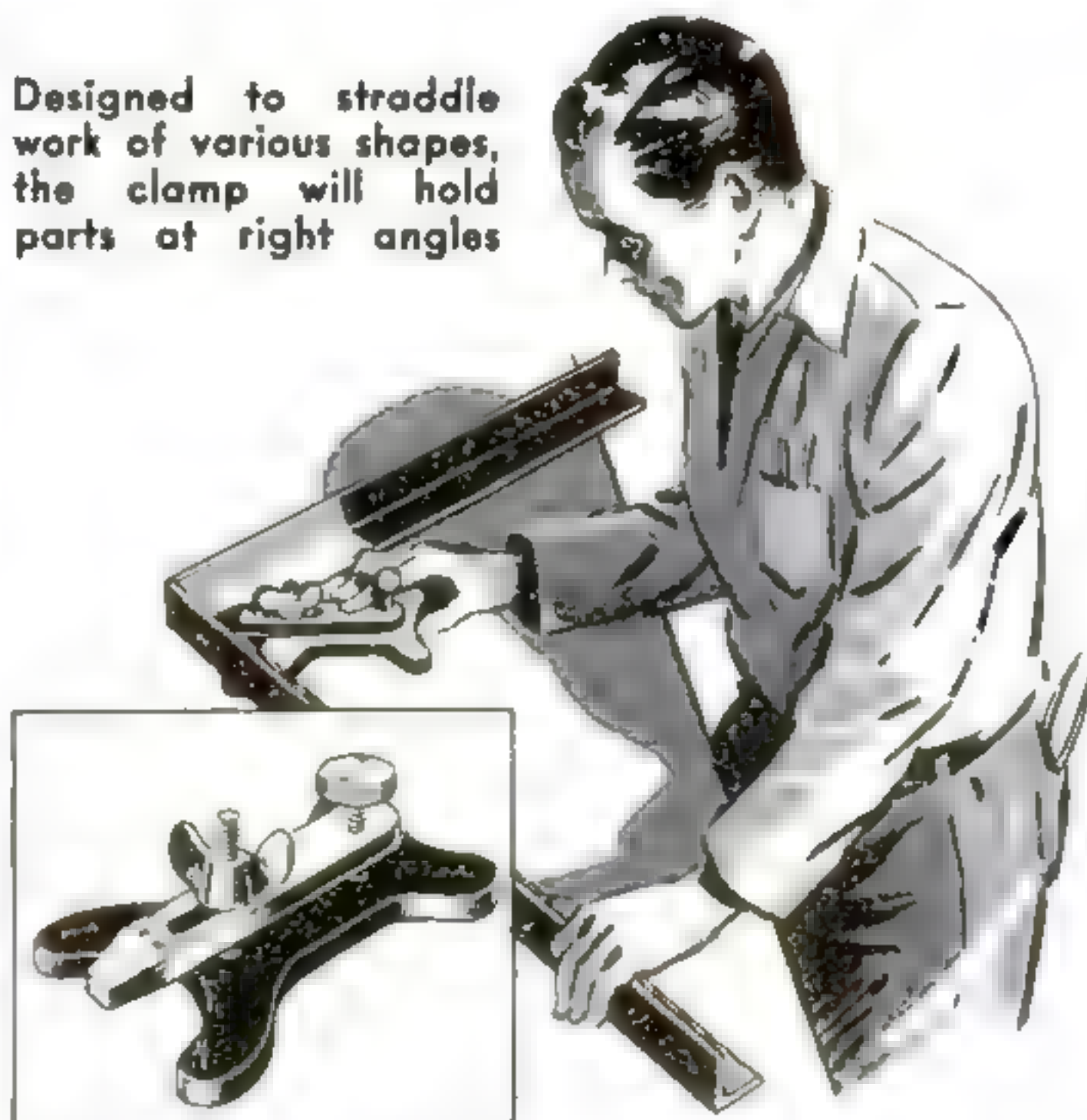
Velvet or other soft material is cemented to the bed of the camera where it will protect the lens

Now turn the flywheel slowly around, allowing the crank and connecting rod to move the treadle. When you find that the assembly works smoothly, remove the connecting rod and bore a $\frac{3}{8}$ " hole in the proper position. Then connect up the "power plant" and tighten the lock nut securely.

All that remains is to attach a $\frac{3}{4}$ " pipe floor flange to the bottom face of the plywood working head and screw this assembly onto the upper end of the pipe shaft. The wheel is then ready for work. It should have an occasional oiling at the guide on the top stretcher and at the working ends of the crankshaft. The ball bearing should be kept well greased. It is a good plan to provide a felt pad with a tin cover over the ball bearing. The pad and cover can be slotted and slipped over the shaft or collar, or they may be a part of the whole assembly and set in position at the time the shaft is dropped into place.

The frame and outside of the box may be painted or varnished, but the inside should be left as it is so that no paint is scraped up with the clay when cleaning up the box. After considerable use, some play will be noticed in the connecting-rod bearings, but thin brass shims will correct this.

Designed to straddle work of various shapes, the clamp will hold parts at right angles



Clamp Holds Angular Work

ALTHOUGH there are countless styles of clamps in use, here is a new type designed for straddle clamping and for spreading the grip over a large area. It should be made from a good grade of steel plate and bar stock. The clamping finger is adjustable in and out and over an arc of the work. One handy use is to hold two parts together at right angles while being welded or riveted.

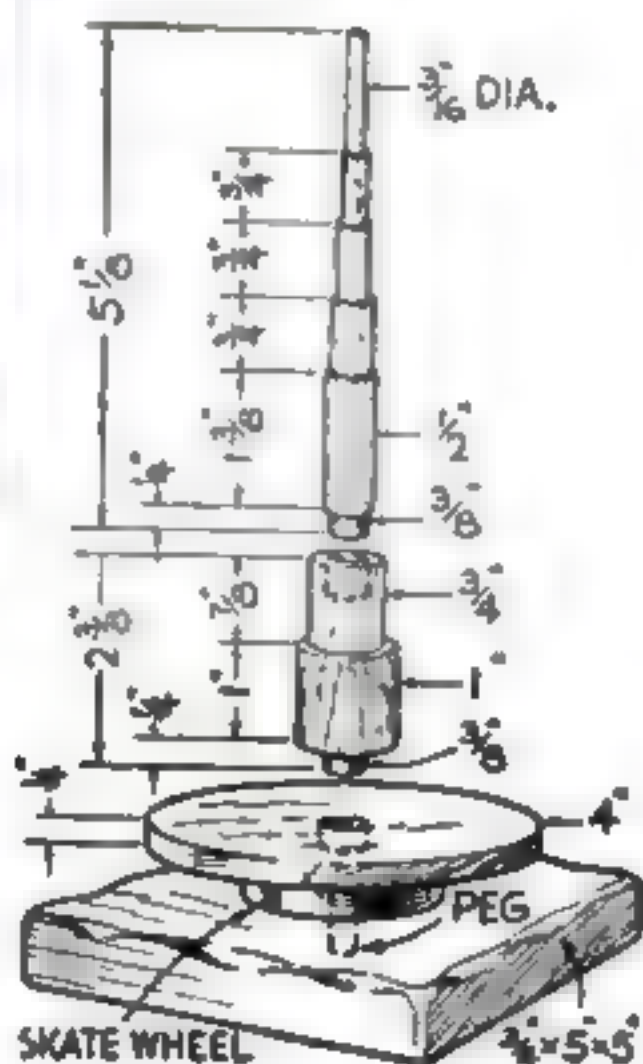


Frictionless Thread Reel for Knitters

to a roller-skate wheel; or, if of wood, is held by means of screws passed through holes drilled in the wheel. Force a wooden peg into the wheel hole, and bore a hole in the wooden stand to receive it.

Make the spindle in two sections, stepping down in diameter as indicated to fit various-sized spools. Turn dowels on the lower ends, so that either section, or both together, may be plugged into the base disk.—EDWIN M. LOVE.

The reel is made of metal or wood



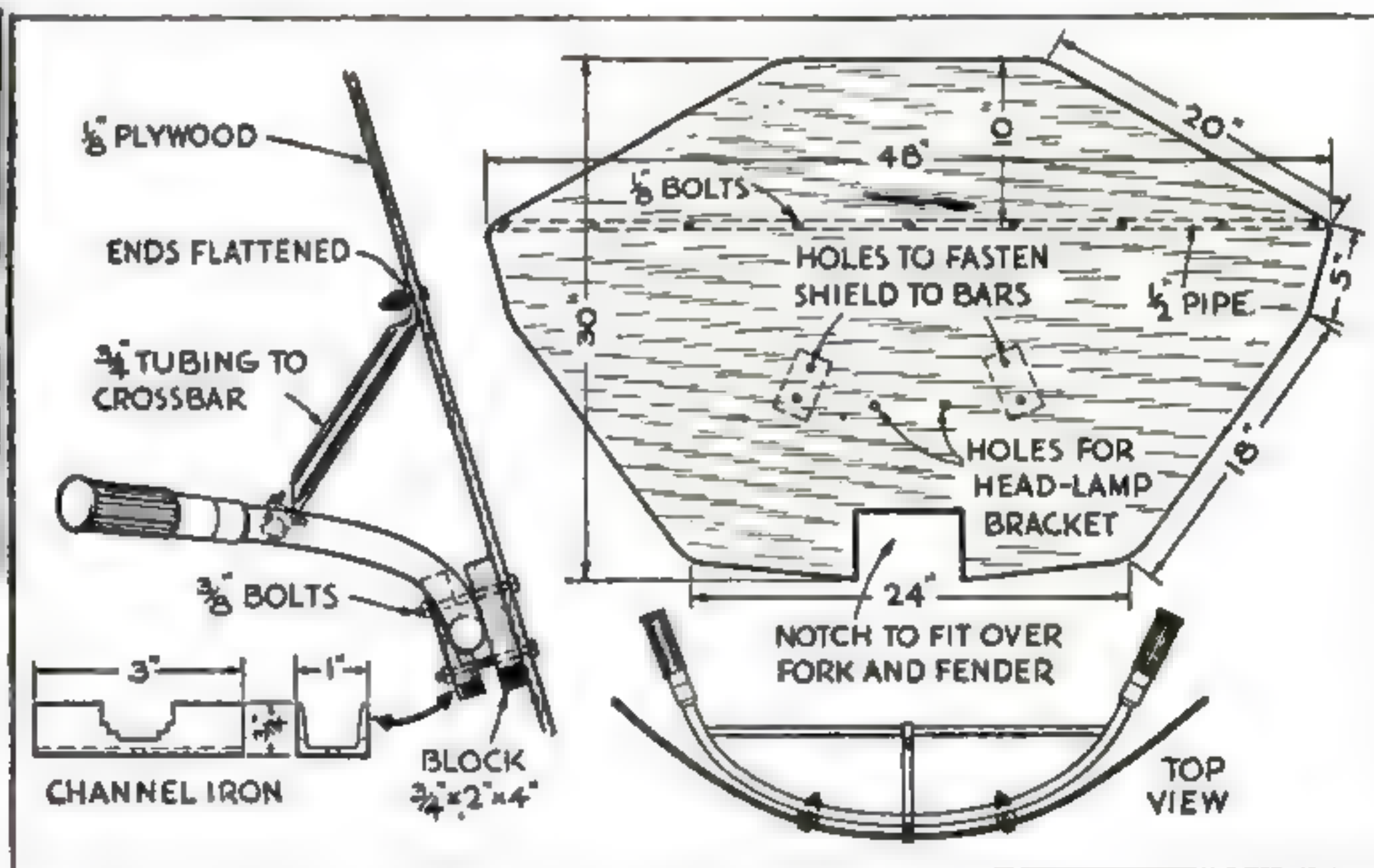
CROCHET cottons and yarns for knitters are conveniently unrolled as needed if the balls or spools are pivoted on this ball-bearing reel. The one illustrated is of steel, but it could just as well be made of wood. The base disk is welded

Motorcycle Windshield Built of Thin Plywood



A LIGHT, strong windshield for any motorcycle can be built as illustrated, although minor changes in dimensions will be necessary to adapt the design to various makes.

The shield is cut from a piece of 1/8" fir plywood 30" by 48", preferably of the type made with water-resisting glue. The plywood is notched to fit down over the fender and over the fork so that it will not lean back too much. A piece of 1/2" pipe is bent to give the shield the desired curve, and the plywood is fastened to it with 1/8" bolts. A piece of 3/4" tubing is fastened to the pipe at the center and to the crossbar on the handlebar to keep the shield upright. Two pieces of channel iron are cut and notched as shown

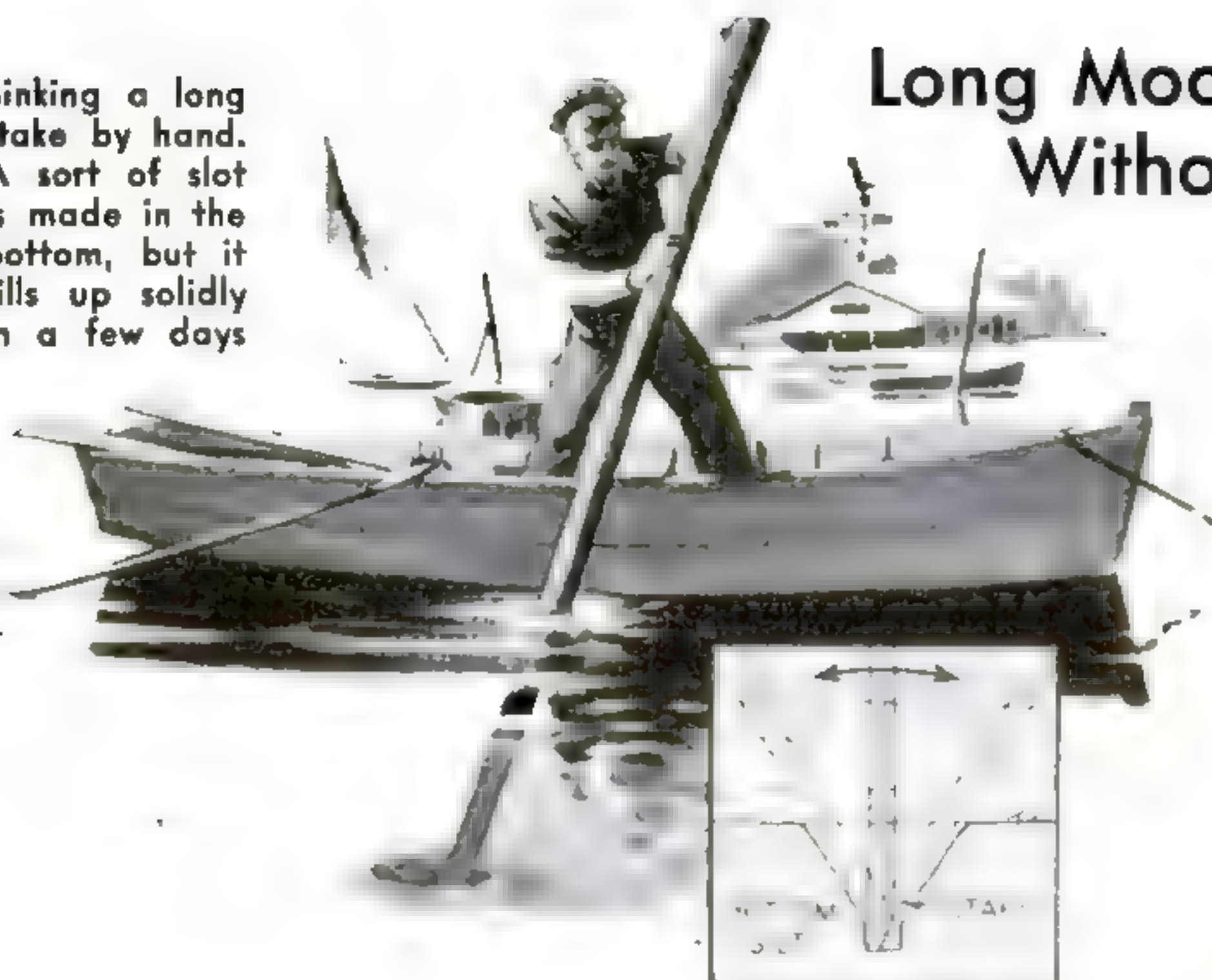


After the shield is shaped, it is fastened to a curved piece of pipe

in one of the detail drawings above to grip the handlebars.

Two holes are drilled through the shield for the head-lamp bracket to pass through. A piece of heavy celluloid may be fastened to the top of the shield if desired, but it is really unnecessary as the wind is deflected over the rider's head. The holes for fastening the shield to the handlebars and for fastening the head lamp may be changed to fit different motorcycles. The shield should be well painted, especially around the edges, after it has been sanded.—EVERETT A. TEACH.

Sinking a long stake by hand. A sort of slot is made in the bottom, but it fills up solidly in a few days

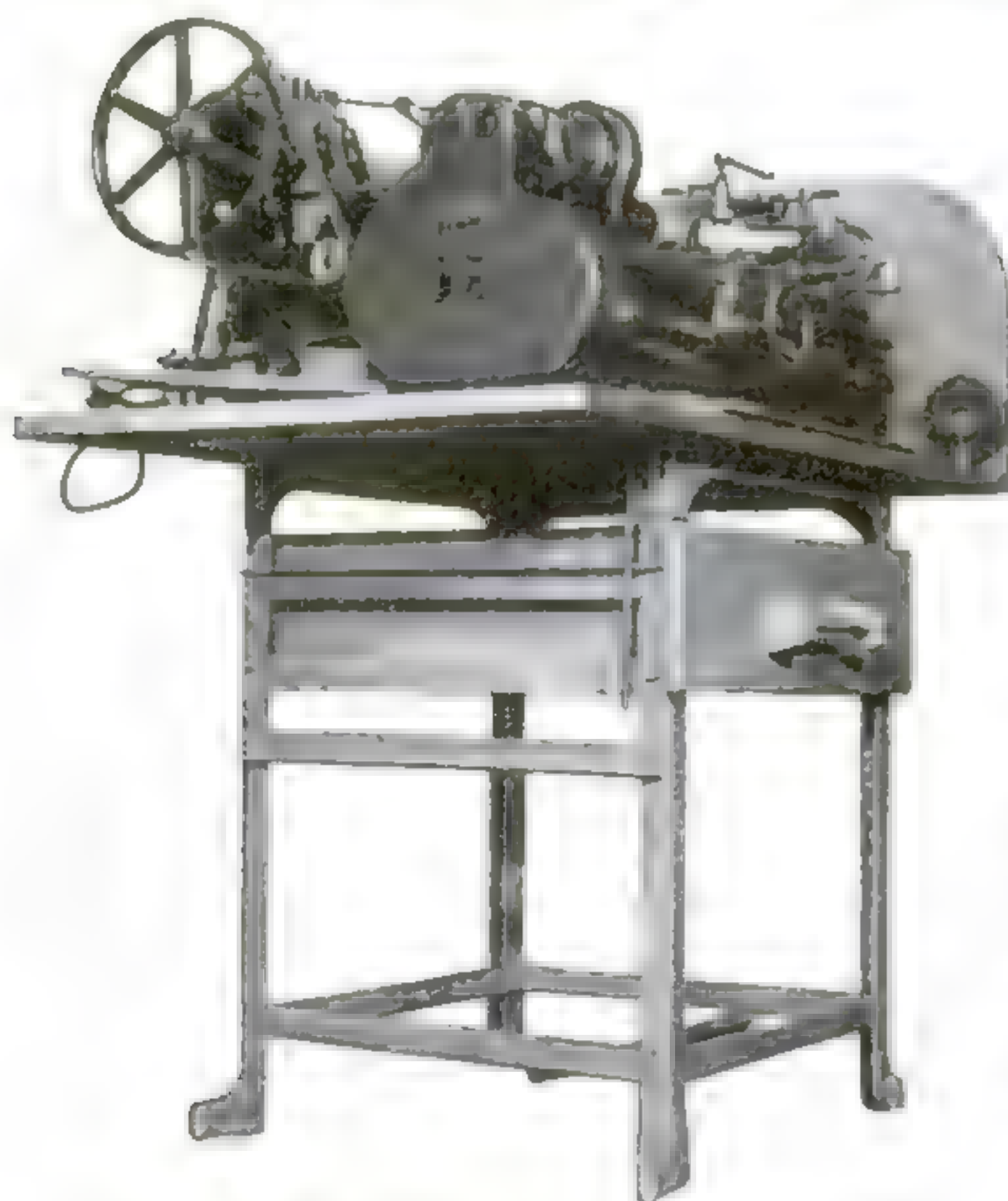


Long Mooring Stake Driven Without Using Tools

A LONG mooring stake, too high for driving in the ordinary way, may usually be forced into firm bottom without using any tools. Trim the bottom of the stake, not to a point but to a sharp wedge. Stand in your boat and jab the wedge end down; then work the stake back and forth, carrying it over to an angle of about 45 deg. and exerting as much downward pressure as possible. This method sank a 6" pile 4' in fifteen minutes.—K.F.K.

Old Tire Casings Push Dirt from Lugs of Tractor

TRACTOR lugs, to provide proper traction, must be kept free of packed soil. Many cleaners or wheel scrapers are sold for this purpose, but a satisfactory expedient is to use lengths of old auto tire casings. These are bolted loosely between the lugs with 6" by 7/16" bolts and washers, as shown at the right. The casings push out the earth before it becomes packed.—D.R.F.



The completed bench. A drawer has been added and there is a tool rack attached to the back

Junked Washing Machine Used as Lathe Bench

THE framework of an old-style washing machine, bought from a junk yard for a dollar, was used in setting up the small lathe illustrated at the left. The top was made from 1" tongue-and-groove flooring, and a drawer and plywood tool rack were added. The casters of the washing machine were kept so they could be replaced if needed.

Motor and countershaft were mounted on a plywood base, fastened with two heavy hinges to the bench top. The weight keeps the belt tight. A rope attached to the back of the hinged base and passing through a couple of pulleys overhead is used to raise the platform for shifting the belt.—C. H.

After sufficient food has been cut off, the remainder is pushed back into the tin can



Dog Food Taken from Can Without Digging It Out

CANNED dog food may be removed from the can in any desired quantity without having a knife or spoon to wash afterward if both ends of the can are cut out with an opener of the type that makes a smooth, circular cut. Push one of the cut ends in until the required amount of food projects out of the other end; then use the tin disk from that end to cut the food off into the dog's dish. Replace the end and push the remainder back into the can.—RODGER DART.

Removing Furniture-Polish Stains

TO REMOVE furniture polish spilled on an upholstered chair, place a clean white blotter over the spot and press with a hot iron. Repeat the operation, using a clean blotter each time, until no more polish is absorbed. If this does not entirely clear the stain, spread powdered French chalk on the spot and leave it overnight.—CHARLES BATTY.

Timesaving Beehive Tool Made from Old Spring

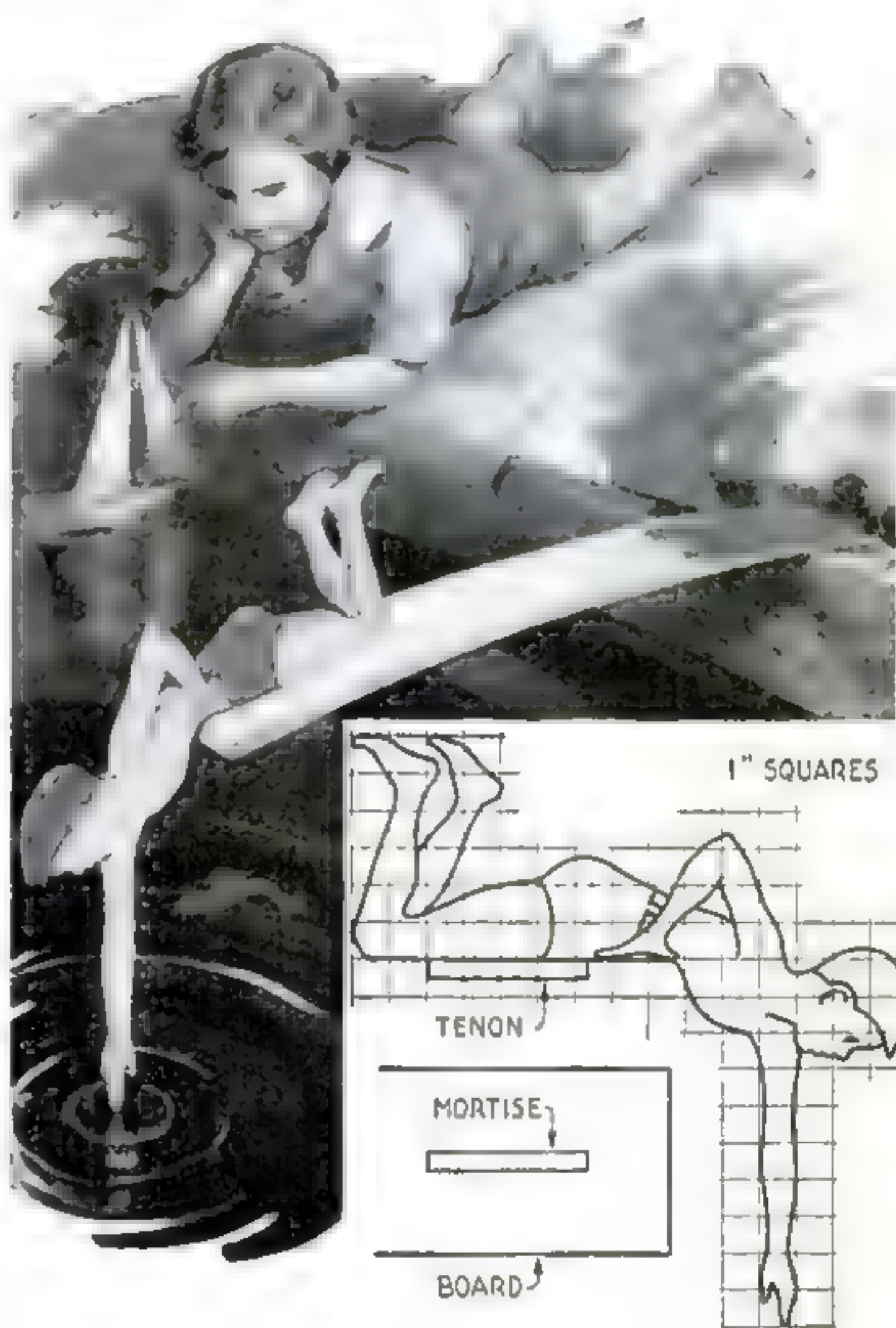
A HANDY tool for lifting beehive lids and prying apart propolis-sealed supers and frames may be hammered from a lightweight buggy or automobile spring. Straighten the spring, flatten and sharpen one end, and form a ring at the opposite end, as can be seen in the illustrations. Through the ring slip a strip of belt lacing for suspension from the wrist, so the tool is always available. The lacing can also be used for hanging up the tool in a place convenient to the hives.

If no facilities are available for this work, a blacksmith will make the tool for a nominal sum.—B.N.



Miniature Diving Board Ornaments a Lily Pool

THIS lily-pool ornament is in the form of a timid young swimmer testing the temperature of the water. The figure is mortised to a miniature diving board which holds him where his finger will almost touch the water. Cut the swimmer from $\frac{1}{2}$ " white pine and paint flesh color, with blue trunks and red hair.—H.F.S.

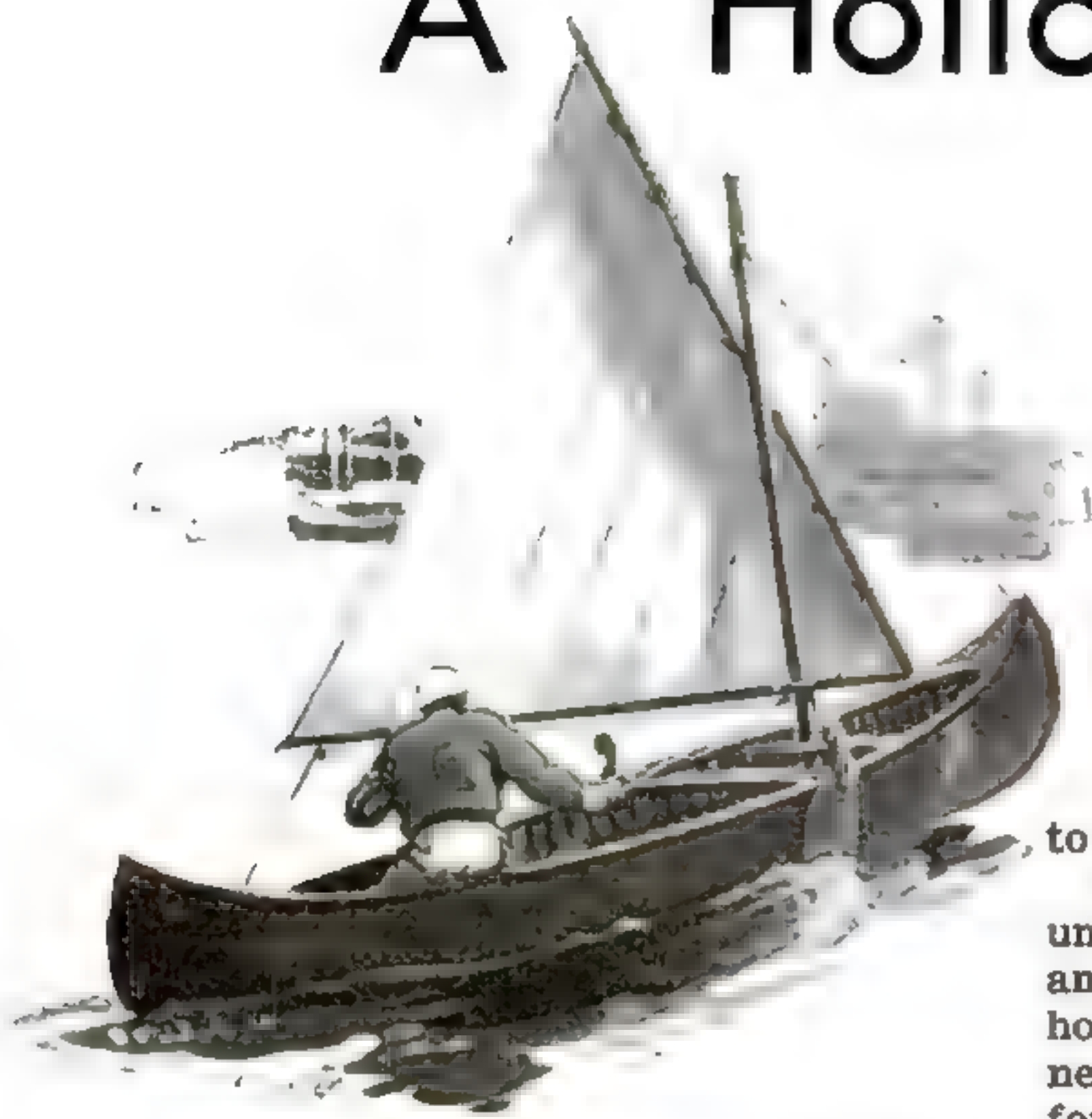


Slung from the wrist, the tool is always handy. It is used for prying apart hive supers and frames

A Hollow Mast for

Here Is a Simple Way
to Remodel Old, Solid,
Heavy Wooden Spars into
Lightweight Modern Ones

By JACK HAZZARD



MANY old sailing-canoe spars need only a little attention to rejuvenate them, and many an outmoded mast may easily be given a new lease on life by hollowing it.

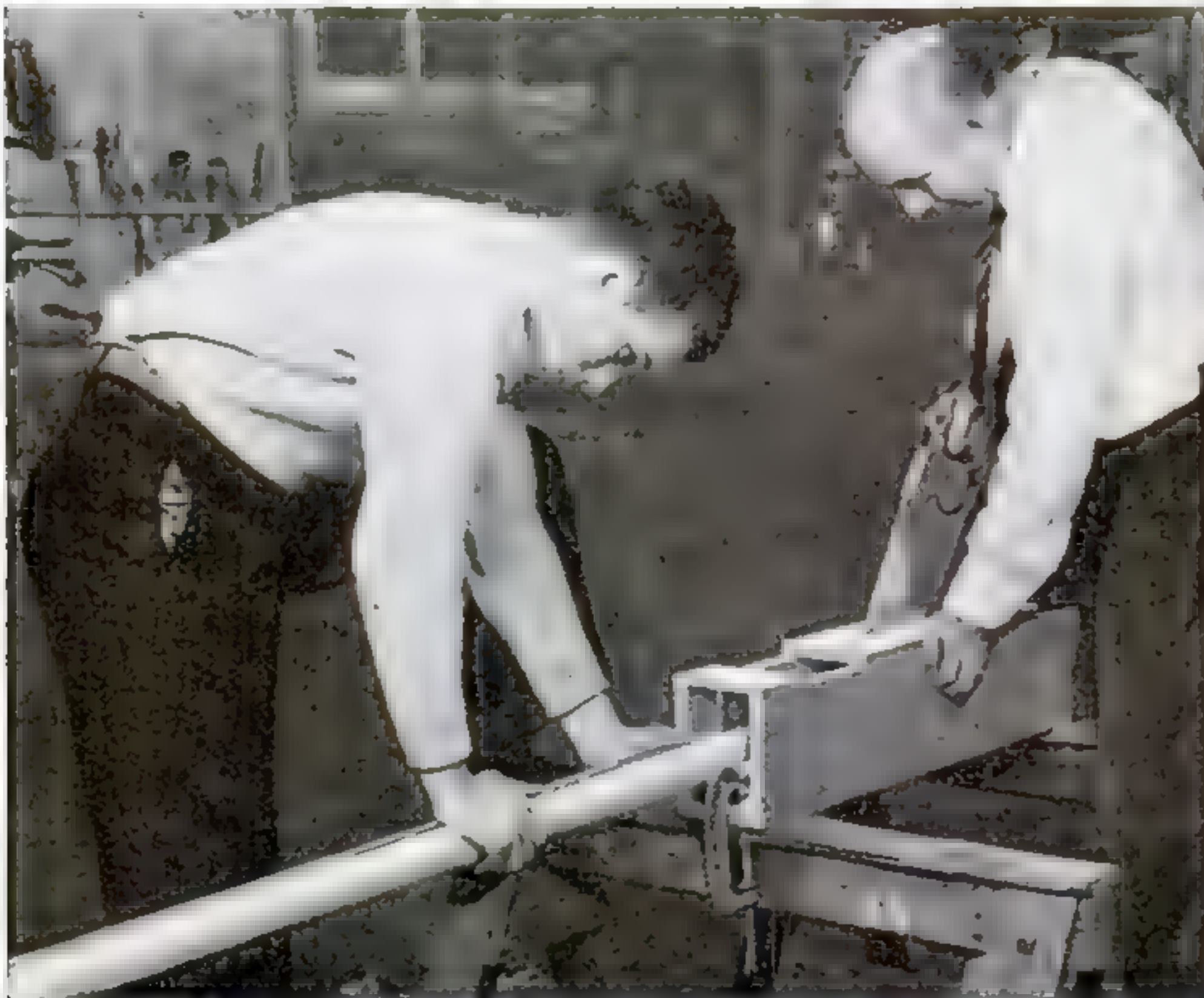
Foremost among the reasons why sailing rigs are discarded is the matter of design. New and better rigs constantly spring up, and the fellow of limited means is obliged to stretch his imagination to the breaking point

to keep his old outfit abreast of the parade.

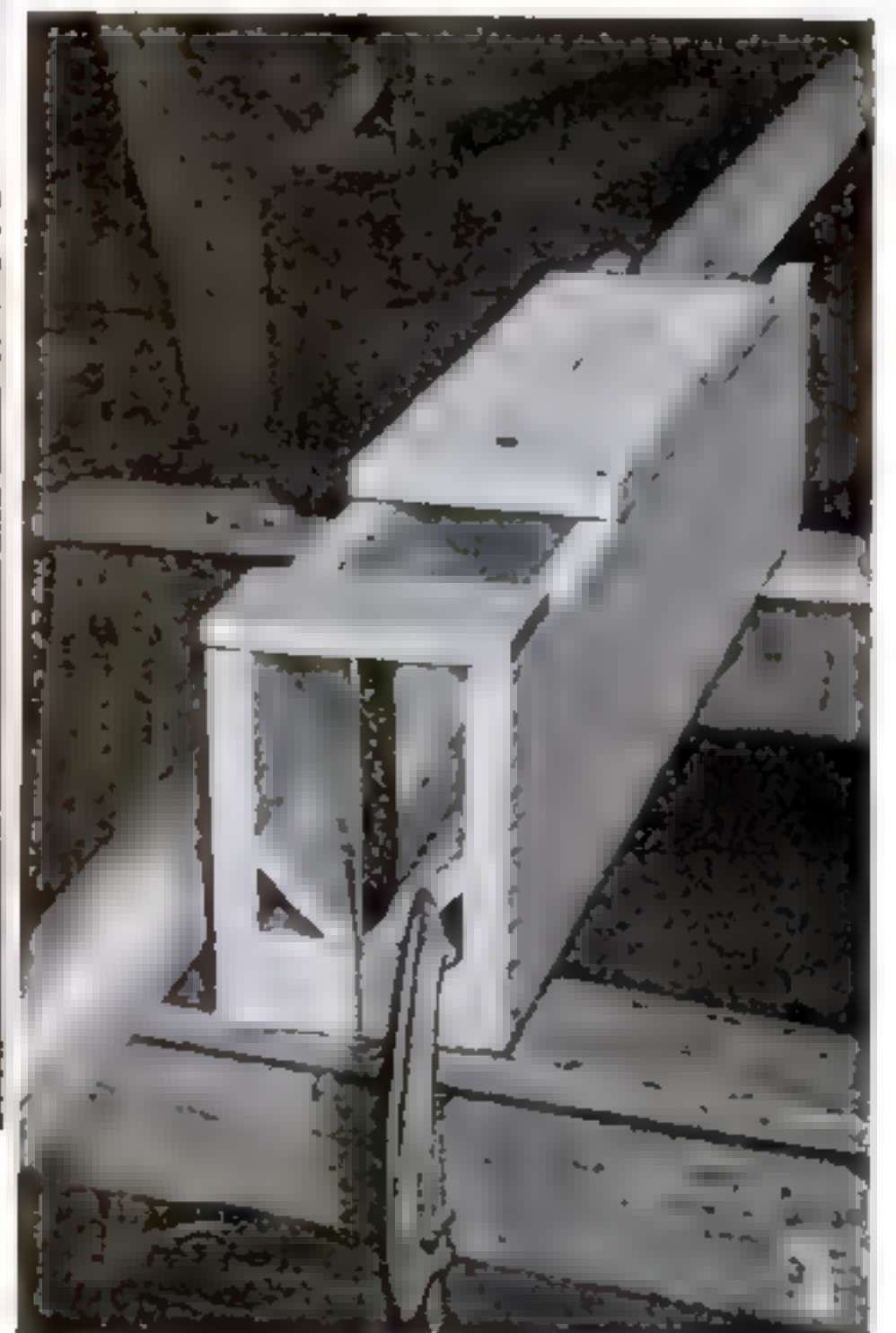
Weight aloft decreases year by year, yet until recently it was thought that no one but an expert dared attempt the building of a hollow spar. Now, however, the building of new hollow sticks has been proved possible for amateurs, and old spars may be reconditioned and lightened. In fact, it is in some ways better to lighten an old spar than to make a new one, for it is known that the old stick is strong enough for its work and the process of hollowing may proceed from that point with the full assurance of satisfaction.

Practical tests have proved that the following rules may be applied: Allow one third the diameter for the total wall thickness.

For example, if the spar is 3" in diameter, allow $\frac{1}{2}$ " of wood all around. Space the webs four times the



The saw box is $5\frac{1}{2}$ " by $7\frac{1}{2}$ " by 29" overall. The base is a 2" by 4", the sides $\frac{7}{8}$ " by $6\frac{3}{4}$ ", the trough sides $\frac{5}{16}$ " thick, the saw-guide deck $\frac{3}{4}$ " three-ply, and the metal "splitter" $\frac{1}{16}$ " brass, $2\frac{1}{2}$ " wide



Your Sailing Canoe

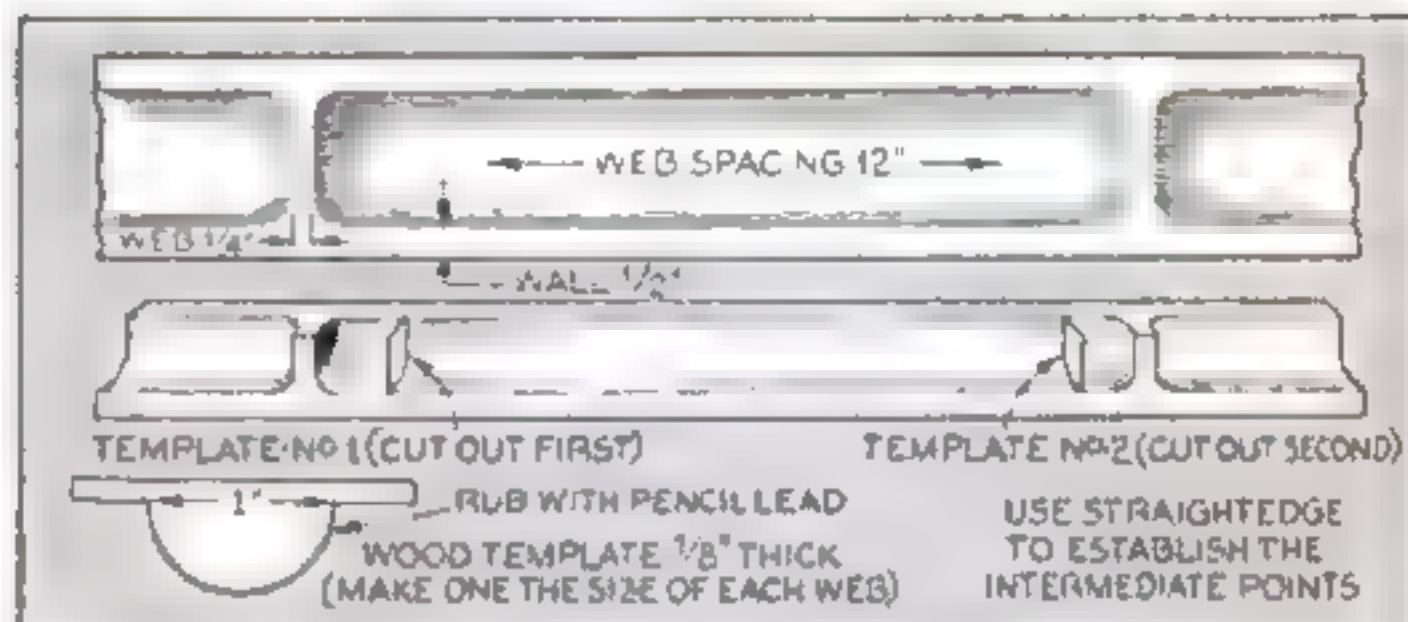
diameter apart, or in this case 12" from center to center. Make the thickness of the webs one-twelfth the diameter, or $\frac{1}{4}$ ". Do not hollow below deck, nor for the last foot above the mast partners. Leave the spar solid where sheaves, spreaders for shrouds, or halyards are to be attached.

The process of hollowing is simple. Saw the mast lengthwise with a fine-toothed rip-saw that is not too widely set, or use a power saw, if available. The sawing should be done to produce flat-grain rather than edge-grain surfaces. A saw box made as illustrated is a considerable help in this work.

If a new mast is being made, two pieces are glued together temporarily, then tapered and rounded in the usual way. The spar is next placed on two padded sawhorses and sprung sufficiently to break the glued joint and enable the halves to be separated. From this point the procedure is the same as for an old spar.

Starting at the foot of the mast, lay out the positions of the webs, and estimate the wall thickness at each station. Connect these marks with lines running parallel to the outside of the mast. The material between the webs is removed with a sharp gouge.

Once the mast is hollow, sand the interior and varnish thoroughly, being careful not to spread varnish on the faces to be glued. Ap-



How the hollow parts and webs are laid out. Above, the spar rests on padded horses while being hollowed



Springing a new mast to break the temporary glued joint used between the halves to facilitate shaping. Left, the final joint is well bound

ply casein glue sparingly on the two halves and allow it to set for ten minutes; then add a liberal coat of glue and press the parts together. Now, with the assistance of a gloved helper, wind the mast closely with thoroughly wetted, cheap cotton clothesline, pulling it as taut as possible, and use a half hitch every three or four turns. Finish off with a clove hitch and, going back to the beginning, work over and tighten the whole binding. As the line dries, it shrinks and produces the pressure needed to make a perfect joint.

The mast is now slightly out of round.



Arrows show direction of strain in spars of various cross sections

Plane away the irregularities. This is a leisurely job, governed more by touch than by sight. Scrape off the old varnish, brush on as much boiled linseed oil as the wood will take, let this dry thoroughly, and re-varnish. You will have reduced the weight from a quarter to a third, yet the strength of the spar will be practically the same as before.

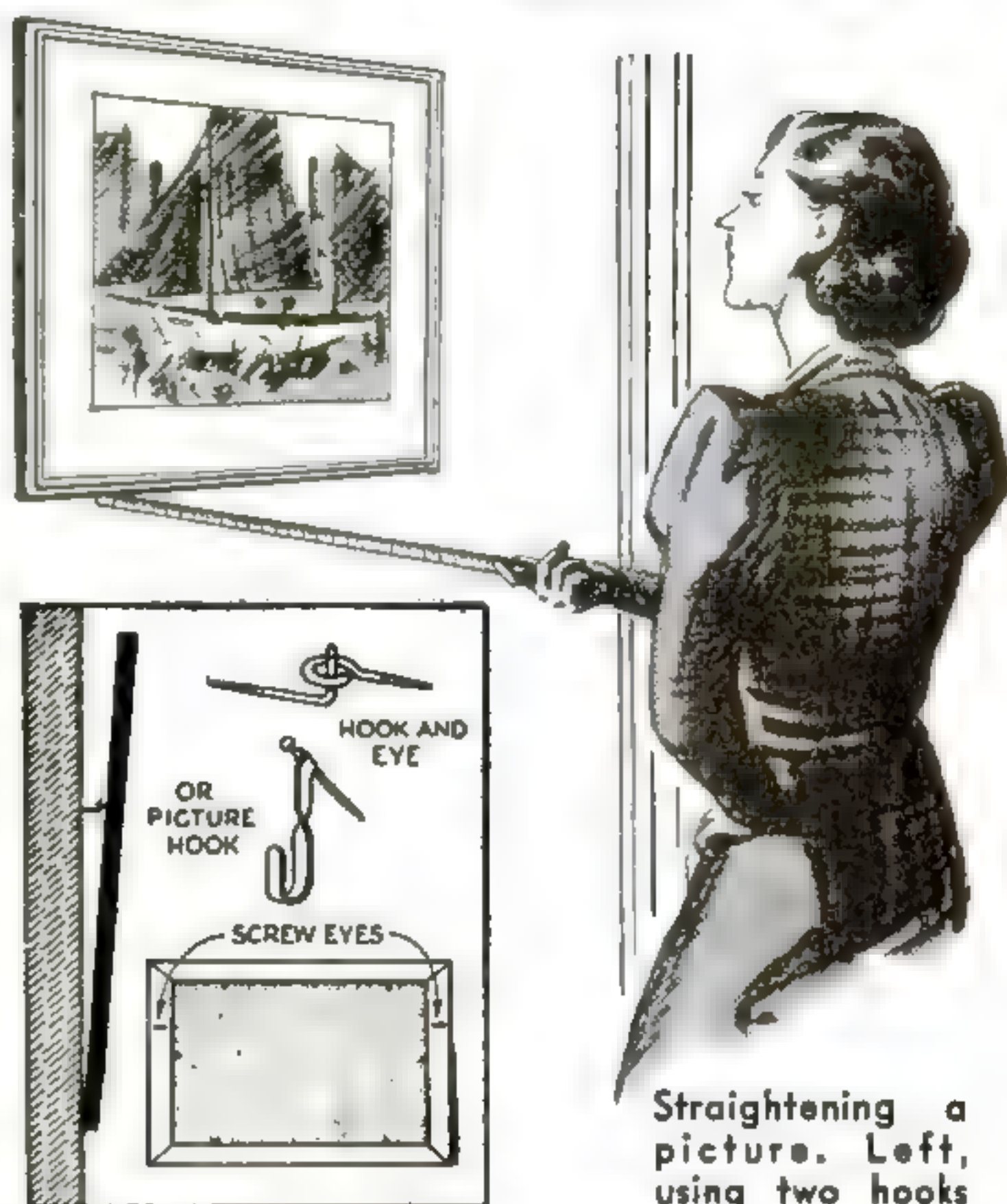
Small spars are best reduced by cutting them to an oval or pear shape as illustrated in the drawing at the left, the greater dimension being opposed to the strain.



THIS accommodating old turtle keeps letters and notes conveniently at hand. The body is sawed from wood about 2" thick. The clothespins should be selected for uniformity of size and grain, then cut as shown and sanded all over. Be sure the inside surfaces of the pins are smooth. Bore holes in the back of the turtle about $\frac{1}{2}$ " deep to receive them.

If the turtle is to be colored, do not glue

Hook on Each Side Keeps Picture Hanging Level

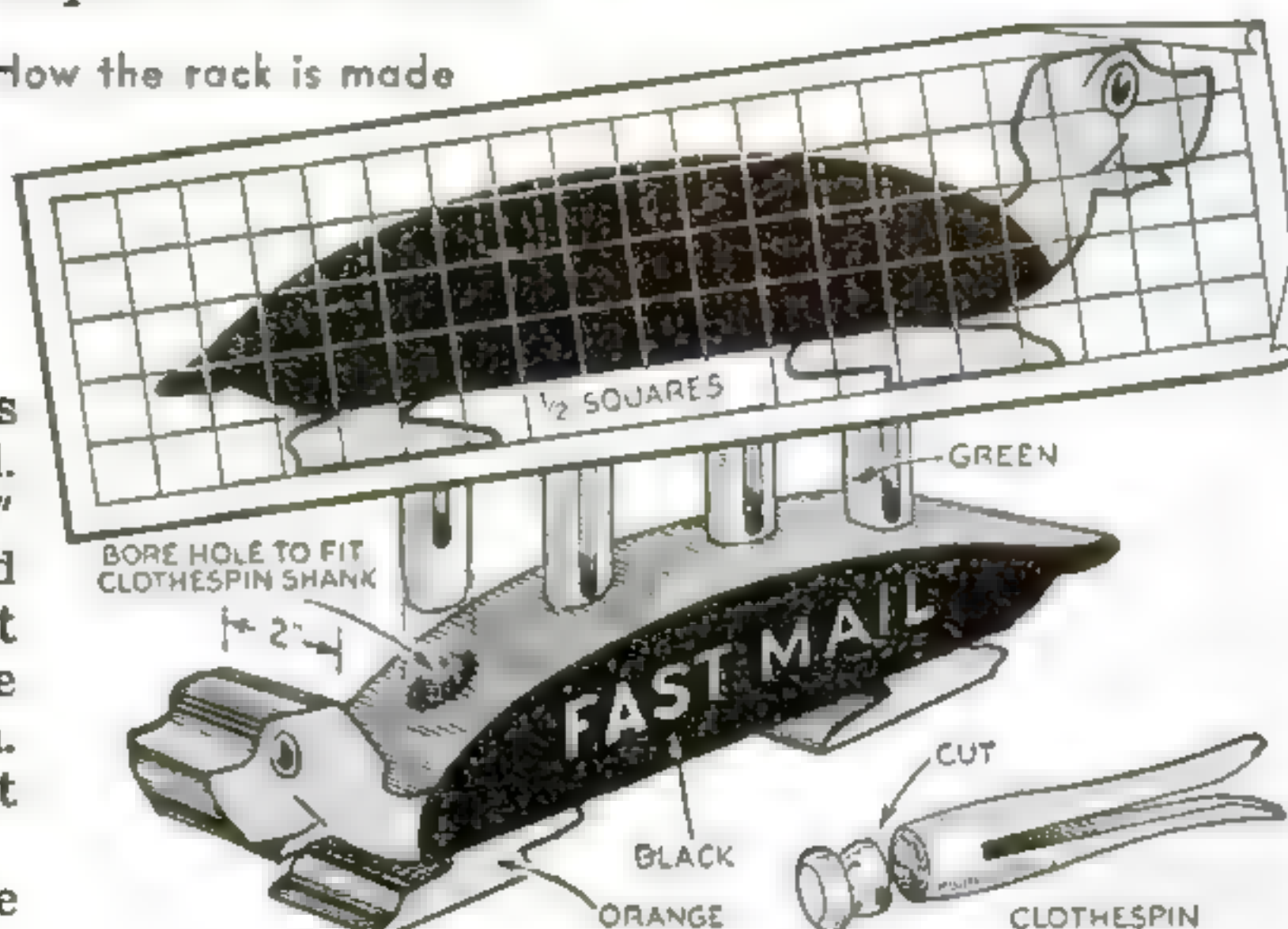


PICTURES that hang from a single nail or hook often get shifted out of line during dusting and cleaning, and a crooked frame will mar the appearance of any room. A good way to align such pictures is to use a yardstick and stand as far away as possible; it is then easier to see when it is level. It is still better to rehang the pictures with two hooks and eyes apiece, as shown, so that they will remain permanently straight.

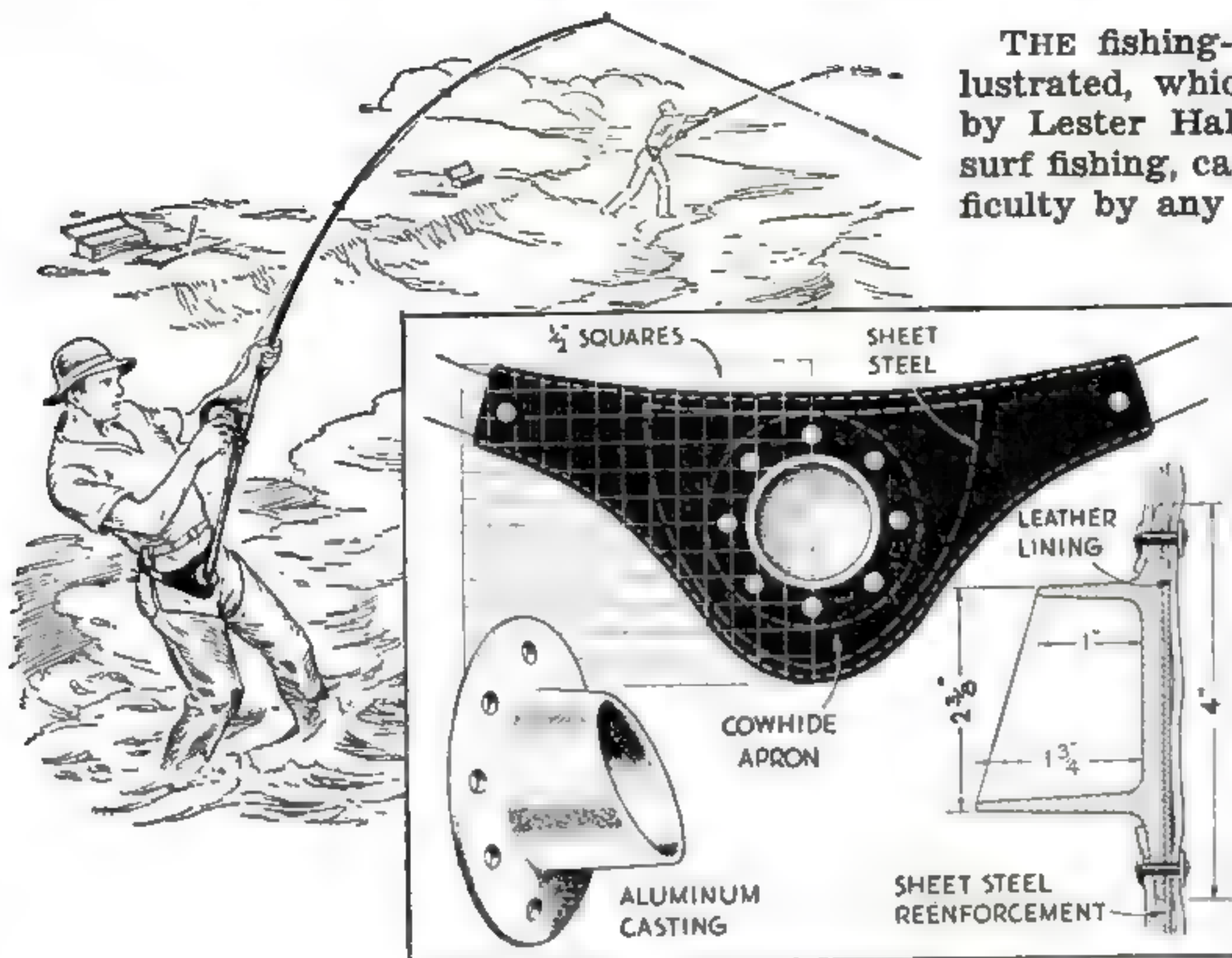
Comical Turtle Carries Letters

the clothespins in until after the painting is finished. Apply a coat of flat white paint or shellac before putting on the color coats of enamel or brushing lacquer.—O. E. OLSON.

How the rack is made



Strong Fishing-Rod Rest Has Aluminum Socket



THE fishing-rod butt rest or socket illustrated, which was designed and made by Lester Hall, of Pasadena, Calif., for surf fishing, can be duplicated without difficulty by any competent amateur craftsman.

The cup is of cast aluminum, and the pattern should be made as indicated, with ample draft for the molder. The rim should not taper down too thin as aluminum cools so rapidly it might not fill the mold.

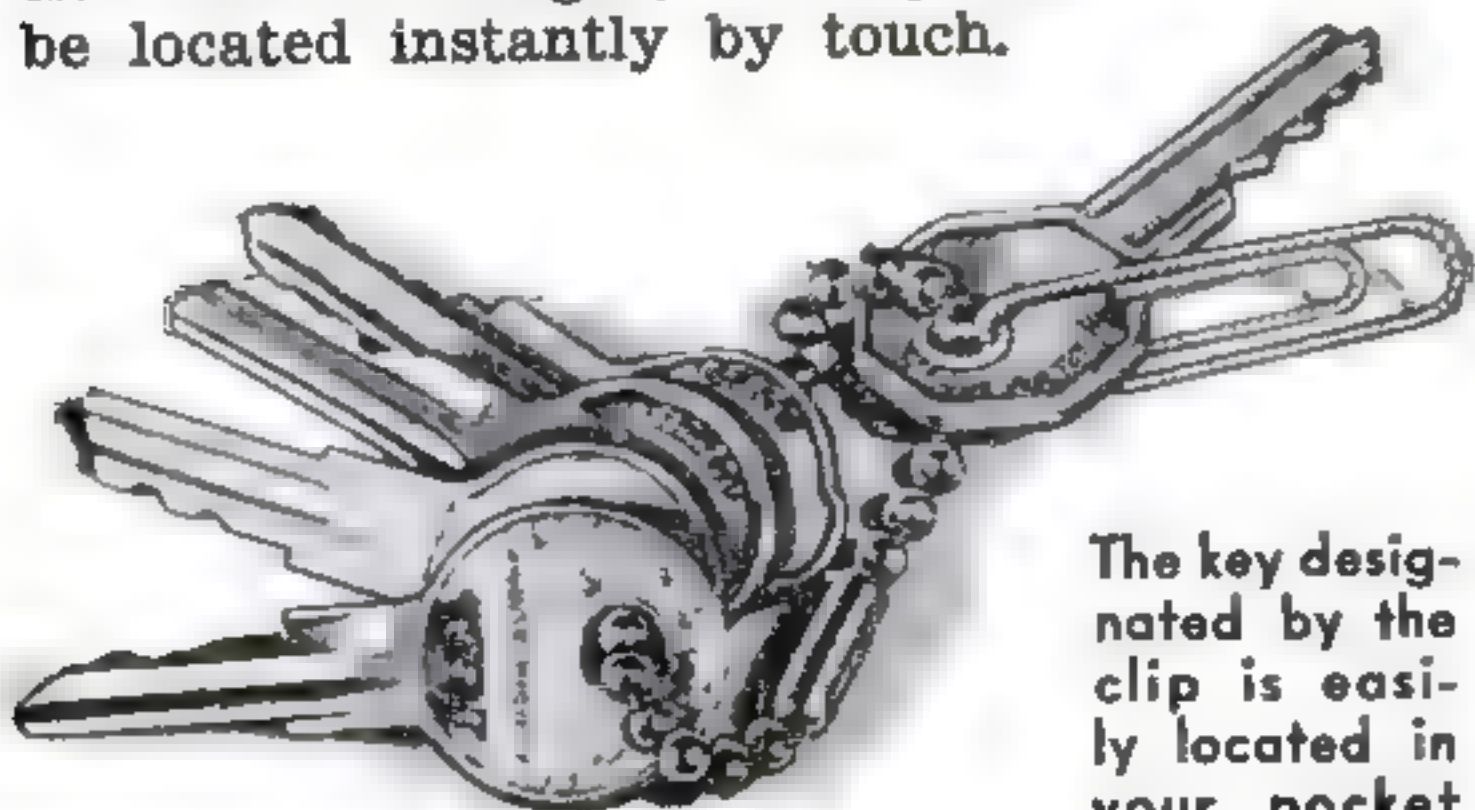
Eight rivet holes are drilled, and a shield of reinforcing sheet steel is riveted to it when the leather apron is added. Cowhide makes a durable apron, but it should be backed with a softer leather.

New Garbage-Can Bottom Made from Extra Lid

WHEN the bottom of a galvanized garbage can gives out but the upper part is still good, an extra lid usually can be made into a new bottom. Knock out what remains of the old bottom, flatten the lid so it will rest level, and fit it over the bottom of the can. Then punch holes and fasten the two together with small bolts. This makes a good can for ashes or dry garbage.—FRED CORNELIUS.

Paper Clip Identifies a Much-Used Key

BY ATTACHING a paper clip to it as shown, a much-used key can readily be identified even if it is carried loose with other similar keys or on a crowded key ring. No matter how dark the night, the key can be located instantly by touch.



The key designated by the clip is easily located in your pocket



Templates for Scrollwork Bent from Bell Wire

ORDINARY bell wire is useful in laying out full-sized templates for metal scrollwork. Bend the wire to shape on a board and tack it down as you proceed.—B. J. ZITEK.

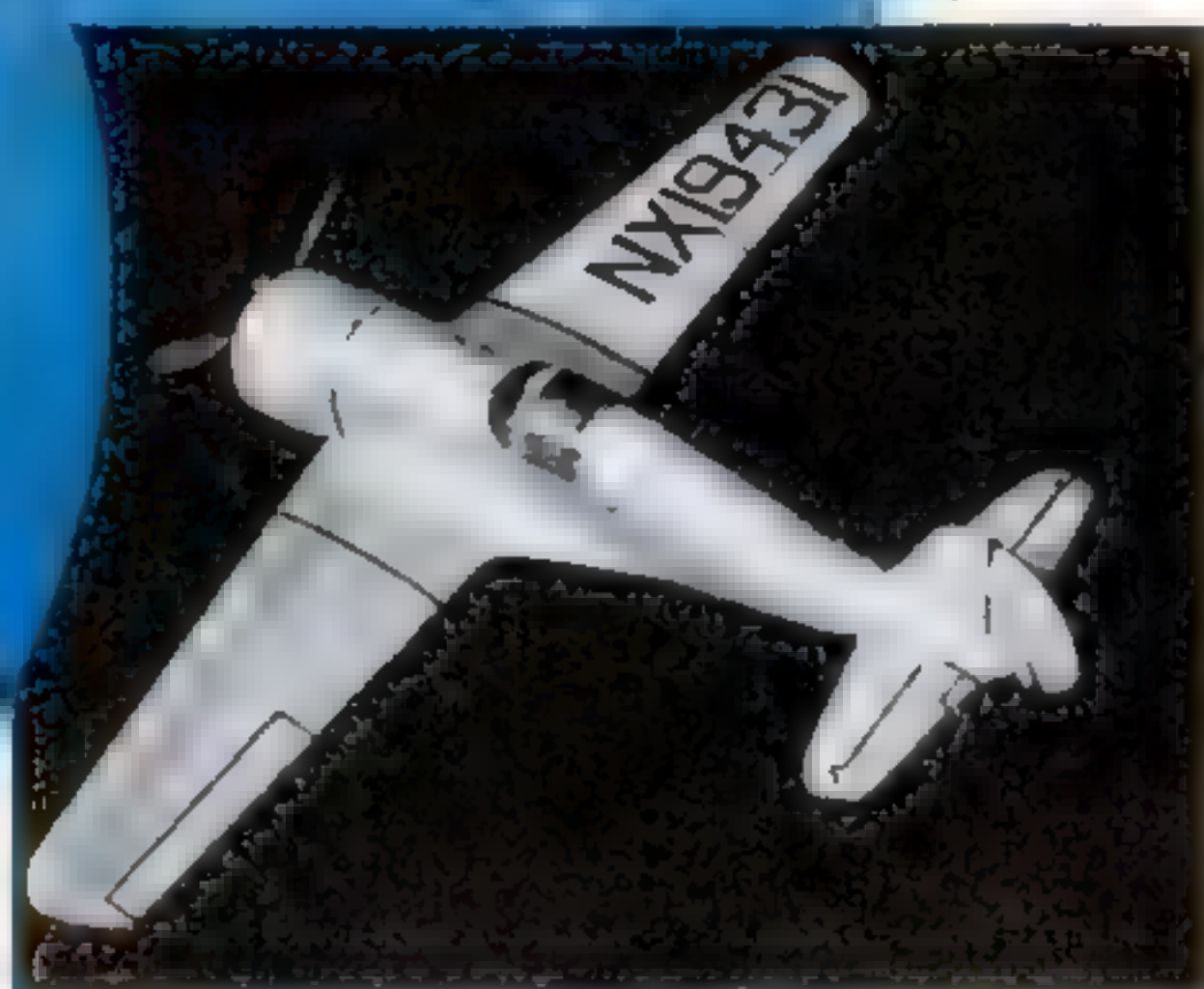


SIMPLIFIED SCALE
MODEL OF THE NEW

Interceptor Fighter

AN INCREDIBLY FAST-CLIMBING
PLANE THAT SPEELS DEATH
TO BOMBERS

The model with
wheels retracted
as in flight



The wing spread is 13" and the overall length 10". Note the use of black lines in painting

By **DONALD W. CLARK**

ONE of the most remarkable combat airplanes yet designed is the new single-engined, low-wing monoplane known as the Curtiss-Wright Interceptor-Fighter or CW-21. With its wing flaps set at an angle of about 8 deg., this plane is said to be capable of climbing steeply at the rate of 5,000 feet a minute, which makes it a formidable weapon for use against high-flying bombers. It has a top speed of more than 300 m.p.h. and a cruising speed of 275 m.p.h.

In constructing the model, our customary scale of $\frac{3}{8}$ " equals 1' has been followed. The drawings are practically self-explanatory, but a few points might be noted.

The wheels retract into streamline housings that are built onto the wings. When the wheels are pulled up, the two halves close together automatically and they open when the wheels are lowered, but this feature has been simplified on the model. Small wire pins serve as turning points at the upper ends of the wheel struts. If these fit tightly, the wheels will stay in either the lowered or

raised position. A small pocket will have to be cut into the underside of each wing for the wheels when in the flying position. The wheels are solid but may be painted with black, as shown, to represent the five spokes.

For making the wing, two pieces are used. These are joined in the opening in the fuselage—an opening that can best be cut with a fine-toothed coping saw. It will be necessary to cut away a little of the wings at this point

SPECIFICATIONS OF CW-21 INTERCEPTOR-FIGHTER

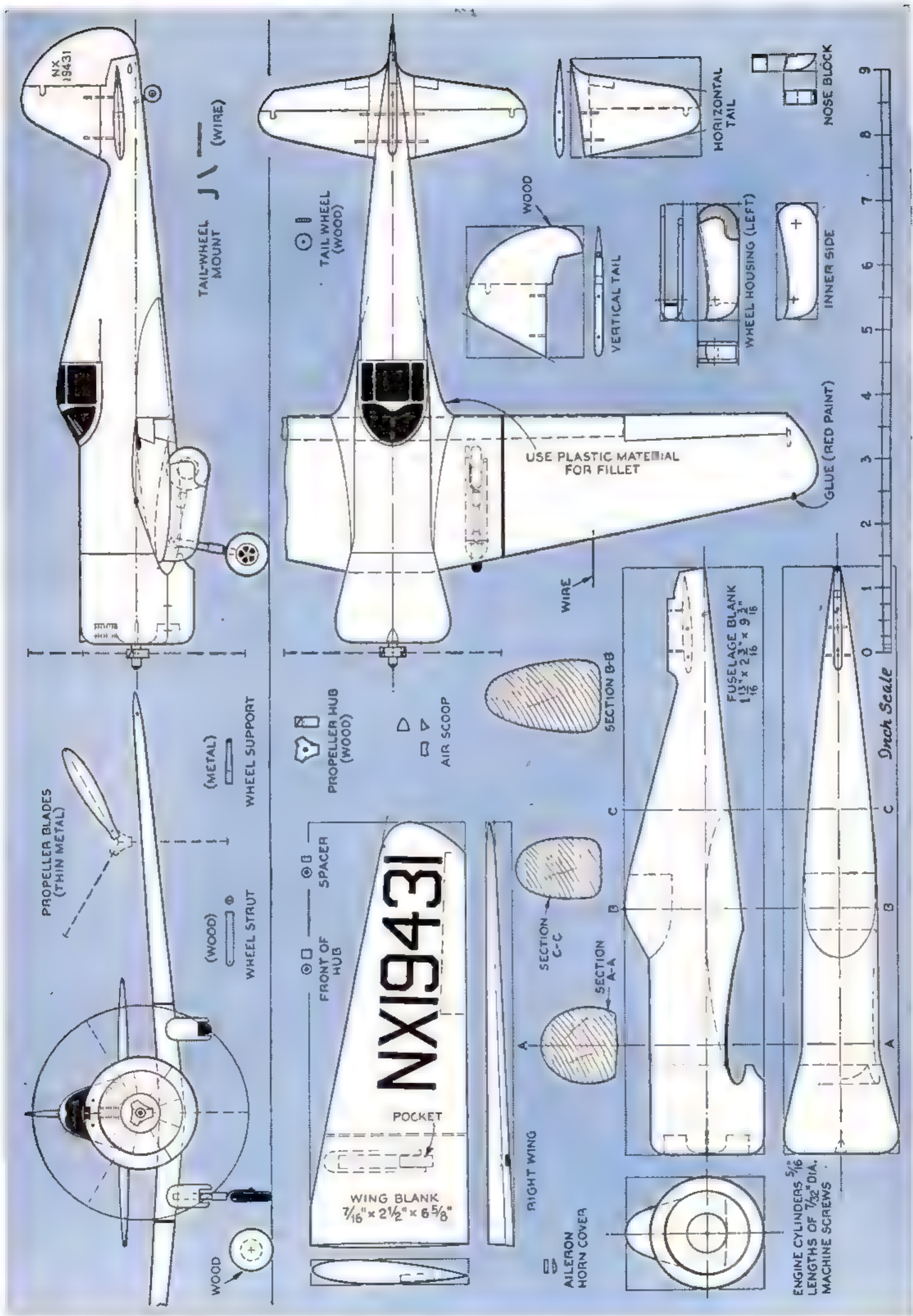
Wing span	35'	Empty weight	3,050 lb.
Length	26' 8"	Useful Load	1,042 lb.
Height	9' 9"	Gross Weight	4,092 lb.

ENGINE

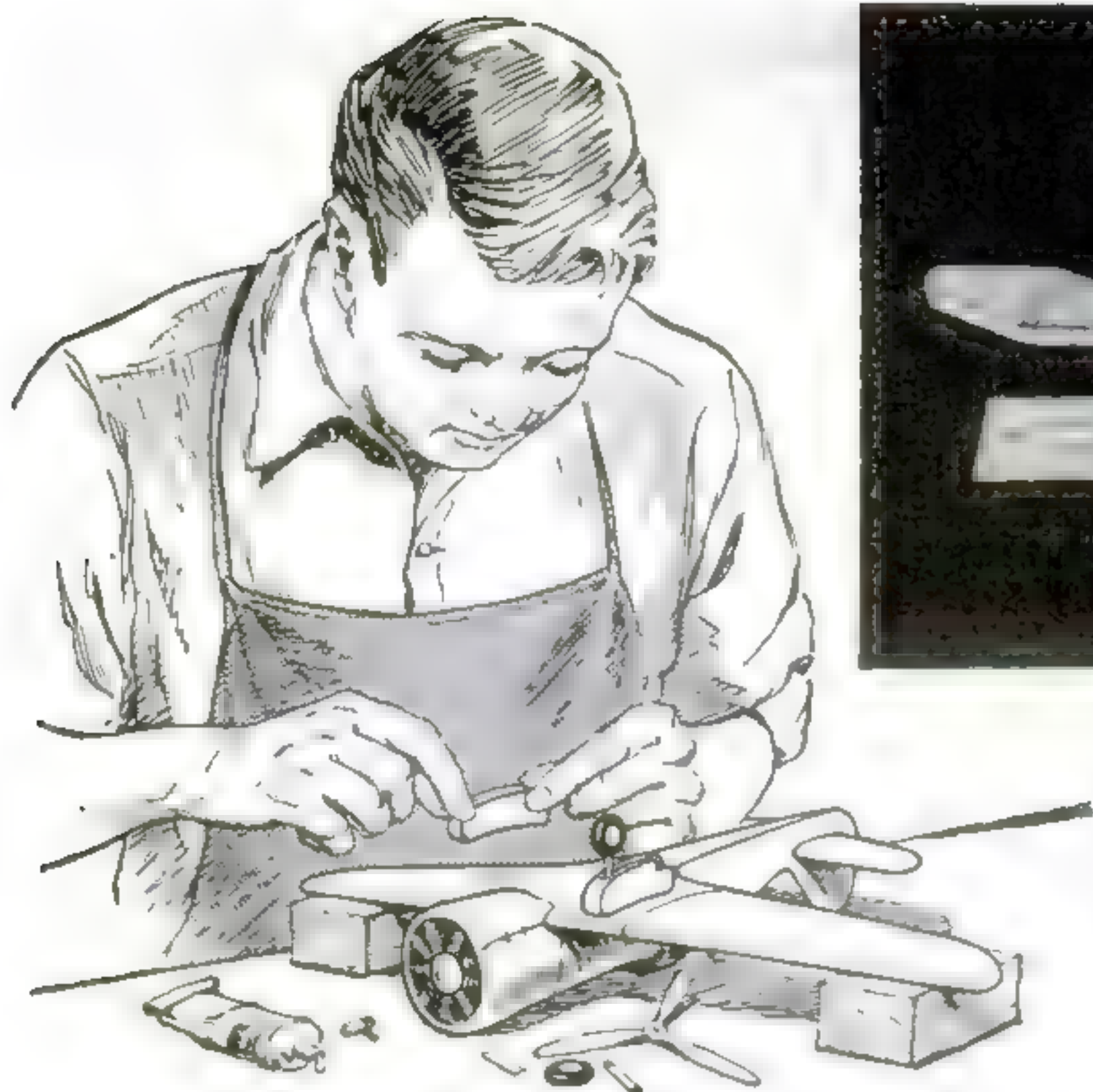
Wright "Cyclone," 9 cylinders, 1,000 h.p.

PERFORMANCE

Max. speed	300 m.p.h.	Service ceiling	35,000 ft.
Cruising "	275 m.p.h.	Rate of climb per minute	5,000 ft.
Stalling "	68 m.p.h.	Absolute ceiling	36,500 ft.



Assembly drawings and details of the wings, fuselage, wheel housings, and other parts, with a scale in inches



The various parts roughed out. The comparatively large piece of $1/16$ " thick wood at lower left is used for the wheel-housing sides

to make a good fit. Fasten them with casein or other strong glue.

On wings and fuselage, mark the outlines of the fillets and roughen these areas with a small chisel. This will allow plastic composition wood, which should be used to form the fillets, to cling to the wood. Thin tag board can be used for the wing flaps, or they can be represented with black lines.

The propeller blades are thin metal cemented into slots in the wooden hub. For the engine cylinders, use $5/16$ " lengths of $7/32$ " diameter bright machine screws, cemented in place. The two black dots on the front of the cowl at the top are openings for the two

Browning machine guns. In the actual ship the engine cowl is hinged along the top edge and the two sections can be lifted up like an auto hood to facilitate inspection and repair.

The model may be painted aluminum, light gray, or olive drab. There is no fixed color scheme for the prototype. Ships of this type are usually delivered by the manufacturer in an aluminum finish with the insignia of the organization or air force painted on the upper and lower surfaces of the wing and on the tail, and usually with a black or gray coat of paint on the upper part of the fuselage extending from the windshield forward. In some instances the ships are completely painted with olive drab or given a camouflaged effect.

This ship was not designed for endurance but to climb quickly the moment high-flying bombers are detected, deal its blow, and return home.

Timesaving Hints to Aid in Building Ship Models

SANDING such hollow surfaces as the curves of ship-model hulls, the cupped side of model airplane propellers, and various types of carved work may be done more easily with a tool constructed from a discarded safety-razor holder of the curved or wafer type. A piece of sandpaper about $1\frac{1}{2}$ " square is wrapped around the outside of the guard, and the ends are folded back so they are held by the toothed piece when the handle is screwed down tight.

Ship model deadeyes may be rigged more easily if all the lower ones for a mast are first attached, and a set of stiff wire hooks with right-angle bends are made to hold the upper deadeyes exactly the right distance away. If these temporary hooks are bent from double wire and fastened into two holes in each deadeye, the deadeyes are prevented

from twisting to the right or left as well as given the proper spacing. It is best not to remove the hooks until one is ready to thread the deadeyes, and then remove one hook at a time, beginning at the forward end of the set of deadeyes for the mast that is being rigged.

Toy Celluloid Pin Wheels Keep Birds Away from Trees

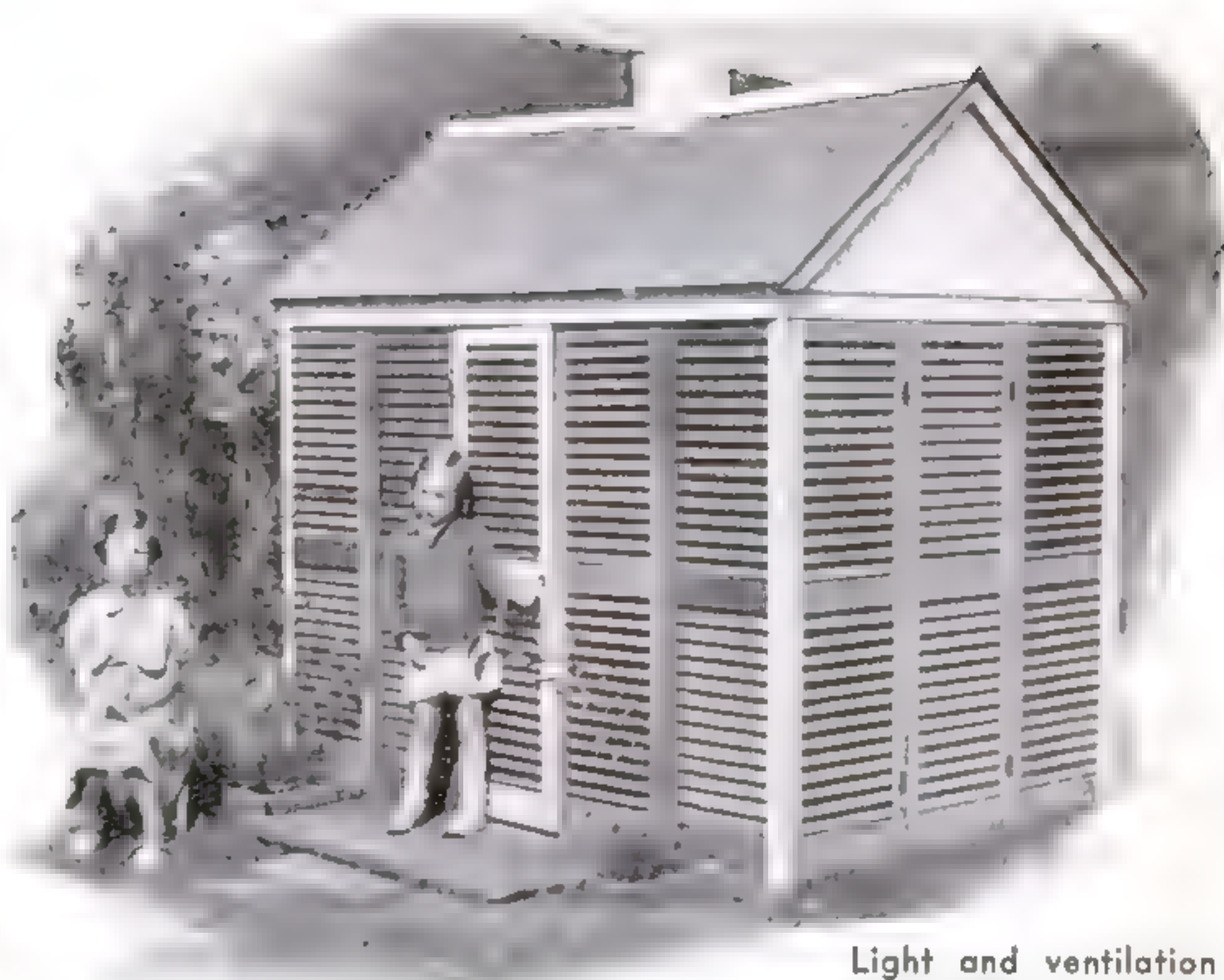
WHEN it is desired to keep birds away from a certain favorite tree or trees, it can be done inexpensively by tying common toy pin wheels of the celluloid variety to the branches. These brightly colored pin wheels are usually obtainable at "five-and-ten" stores. They seem to keep the birds away, whether still or moving.—NORMAN COOLEY.

Portable Playhouse

BUILT FROM OLD WINDOW BLINDS

IF A NUMBER of old window blinds are available or can be obtained from a dealer in secondhand building supplies, it is possible to make a portable playhouse at comparatively small expense. Such a playhouse is better than the usual type in that both the light and ventilation can be controlled by opening or closing the shutters. It is also possible to move it from one place in the garden to another.

The playhouse illustrated, which was built by a minister in Arena, N. Y., is five blinds long and three blinds wide. They are nailed at the bottom to a rectangular frame, or sill, of 1" by 5" boards. At the top there is a similar frame of 1" by 3½" boards, and on



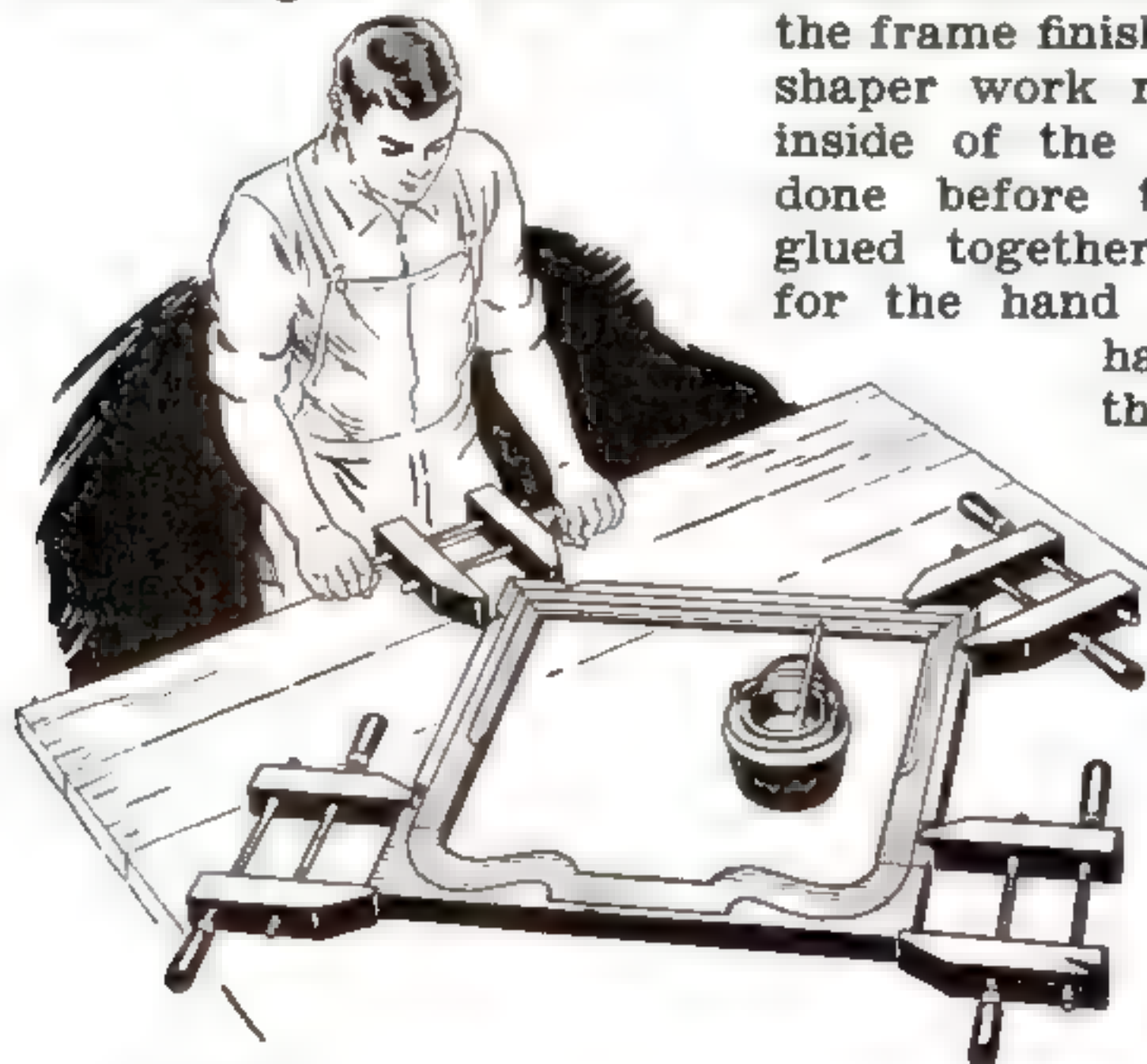
Light and ventilation are easily controlled

this are laid ten rafters—five on each side—of ¾" by 2" wood. Any available boards may be used for the roof and the gable ends. The roof is covered with roofing paper, and the chimney, which is about 6" square and 8" high, is made of boards. The door is outlined in white, and the rest of the house can be painted green or any other color.—C. S.

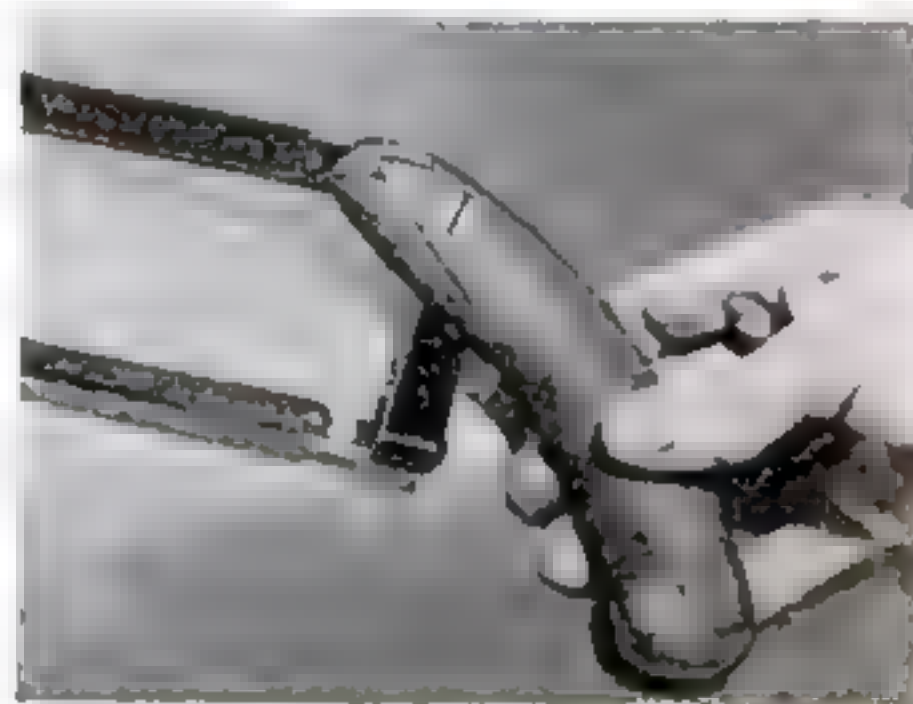
Notches Are Aid in Gluing Frames

A COMMON expedient in gluing the corner joints of mitered frames and other difficult work is to glue on temporary triangular-shaped blocks of wood or "ears" in order to provide a suitable grip for the jaws of the hand screws. If, however, the stock for the frame is of sufficient width, an easier way is to cut notches for the hand screws as shown. When the glue is well set, the excess stock is ripped off and

the frame finished to size. Any shaper work required on the inside of the frame may be done before the pieces are glued together. The notches for the hand screws do not have to be more than ½" deep.



If the stock is wide enough, notches are cut for the clamps. The excess wood is ripped off later



Modern Pistol Grip for Your Hack Saw

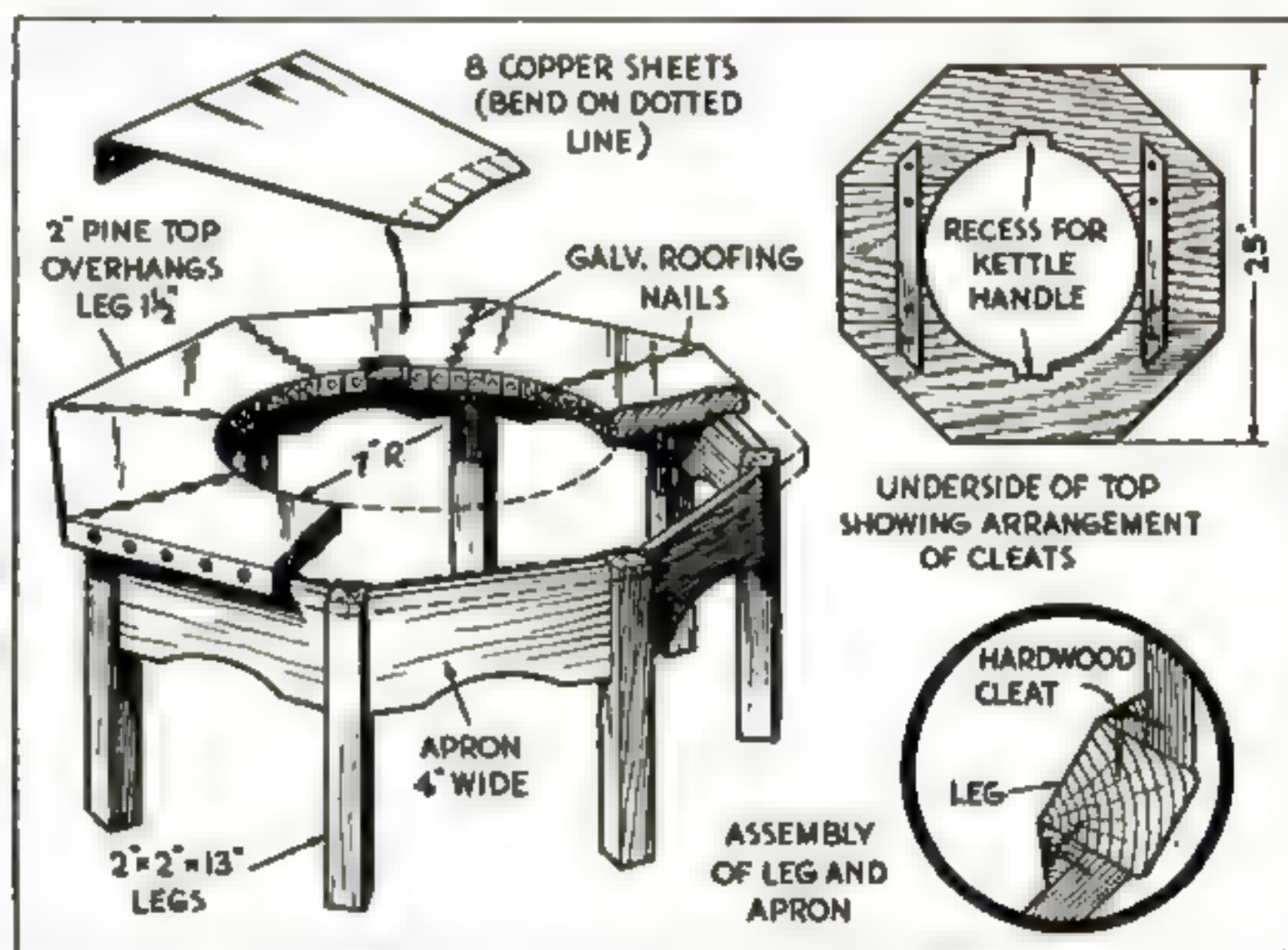
YOU can modernize an old hack saw by removing the handle and substituting an 8" section cut from a notched wooden steering wheel, obtainable at any auto graveyard. One end is slotted to fit over the frame of the saw and drilled to take two saw-handle bolts; the opposite end is rounded off smoothly with a knife and then finished with sandpaper.—B. N.



Portable Mexican grill with copper-covered top

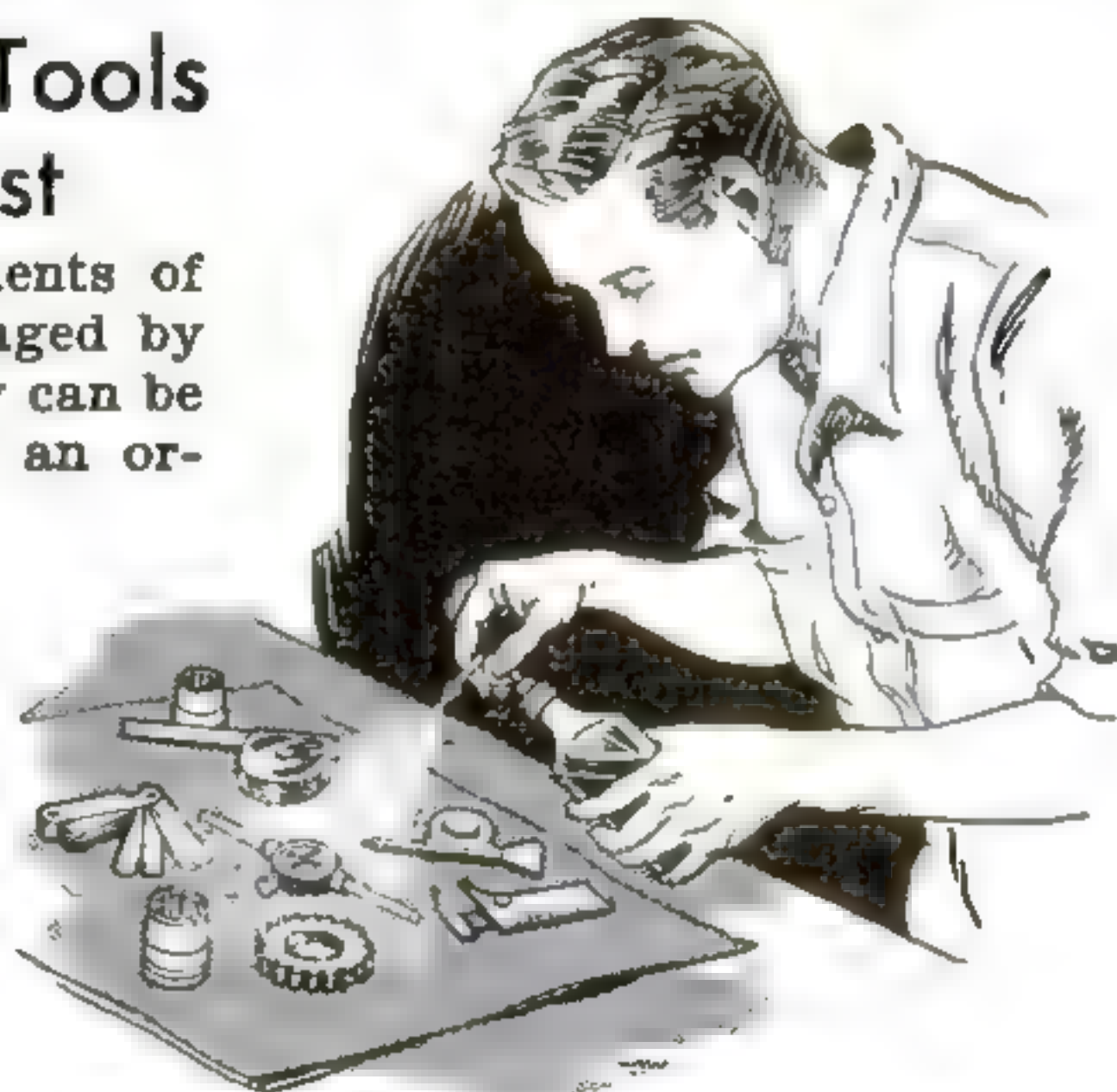
An Ornamental Barbecue for Garden Luncheons

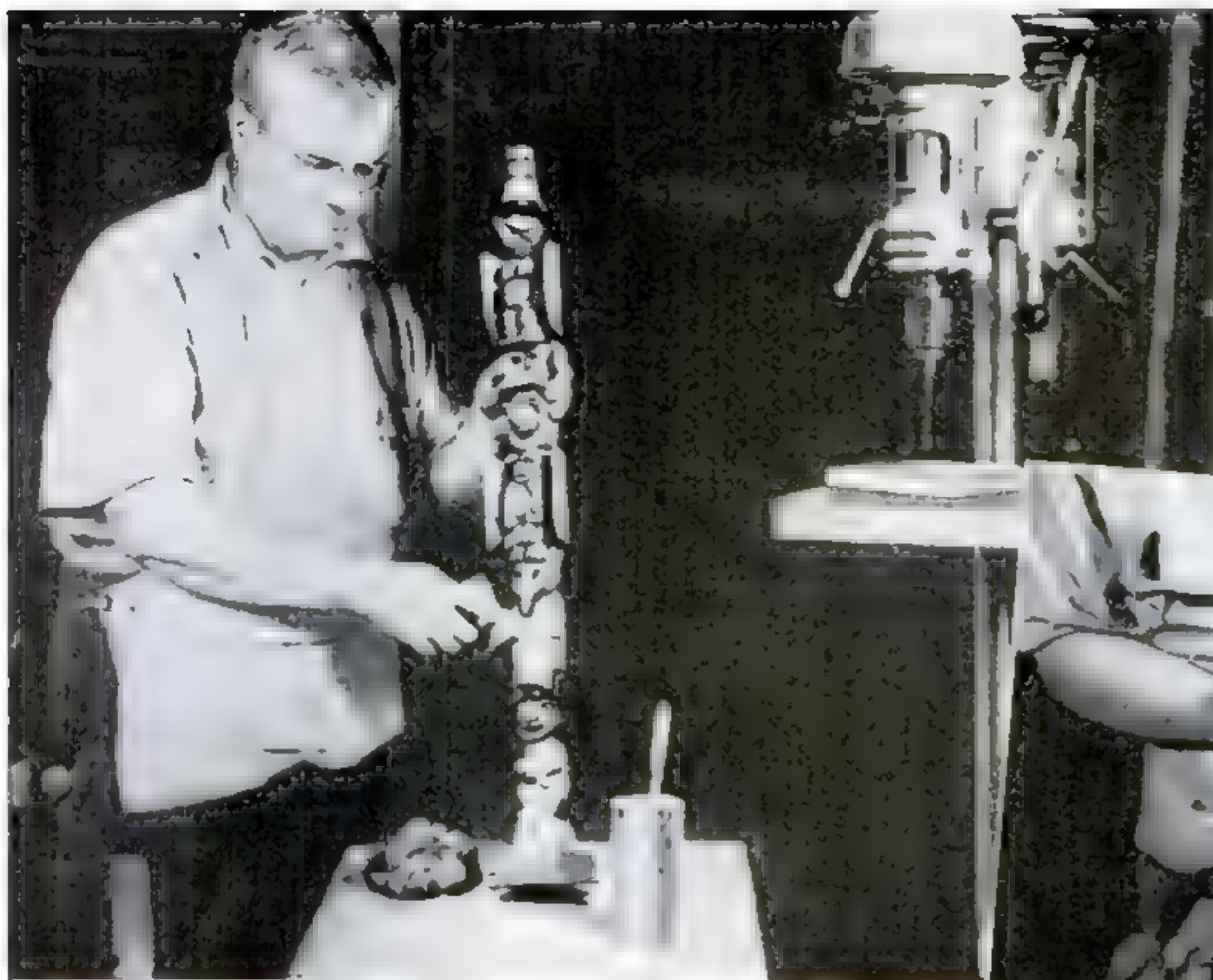
IN THE rural districts of Mexico, the peons make efficient barbecues or grills of the simplest construction. A favorite type is a five-gallon gasoline tin with the top cut out. Sand is placed in the bottom, and several iron bars are laid over the top. The elaborate arrangement shown in the accompanying photograph is a duplicate of a Mexican design made by Durlin Brayton, of Laguna Beach, Calif. This portable barbecue consists of a low octagonal table of rough pine with a round opening in the middle to receive a large iron kettle. The protruding handles prevent the latter from slipping through. The top of the table is covered with hammered copper sheets, secured with large-headed galvanized roofing nails. The exposed wood is finished in weathered stain with a pleasing effect. Cooking is done on a grill over a charcoal fire laid in sand, which fills the kettle to within about 6" of the top.



Wax Solution Sprayed on Fine Tools to Prevent Damage from Rust

FINE, highly polished tools, scales, and instruments of precision are often made unsightly and even damaged by rust caused by the moisture of one's hands, but they can be protected by applying the following solution with an ordinary fly sprayer: Place a piece of paraffin the size of a marble in a can holding about a cupful of carbon tetrachloride, set the can in boiling water, and stir until the paraffin has dissolved. When this is sprayed, the carbon tetrachloride will carry the wax to every part of the surface, but will evaporate in a few moments, leaving a very thin film of wax. This also makes a satisfactory lubricant for locks, hinges, and car doors.—W. C. C.

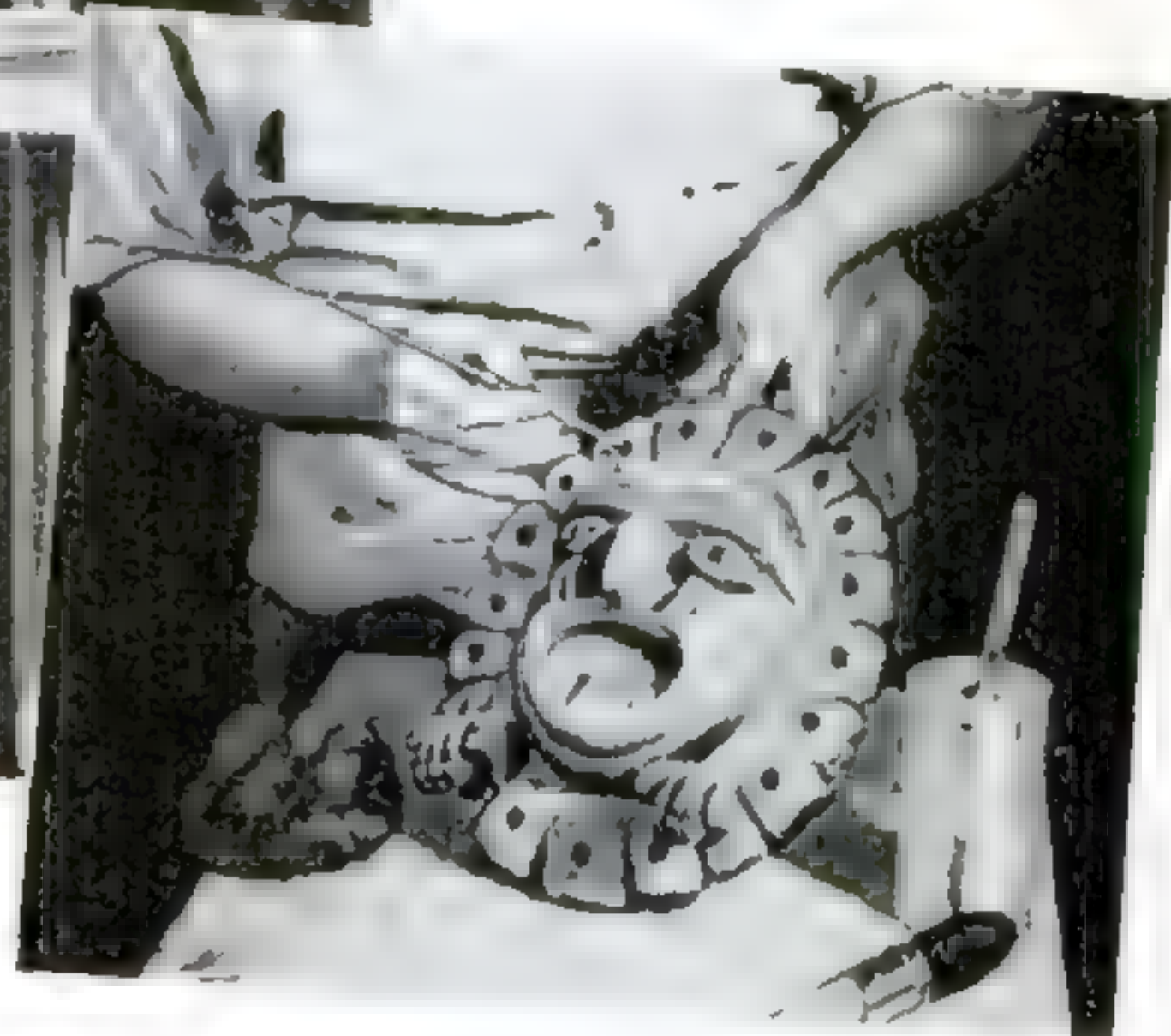




Charles H. Hunt, of Long Beach, Calif., puts the finishing touches on one of his miniature totem poles now on display in San Francisco. At the right, a wooden ceremonial mask



Official Magazine
POPULAR SCIENCE
MONTHLY



Guildcrafter's Indian Carvings Win Acclaim at Fair

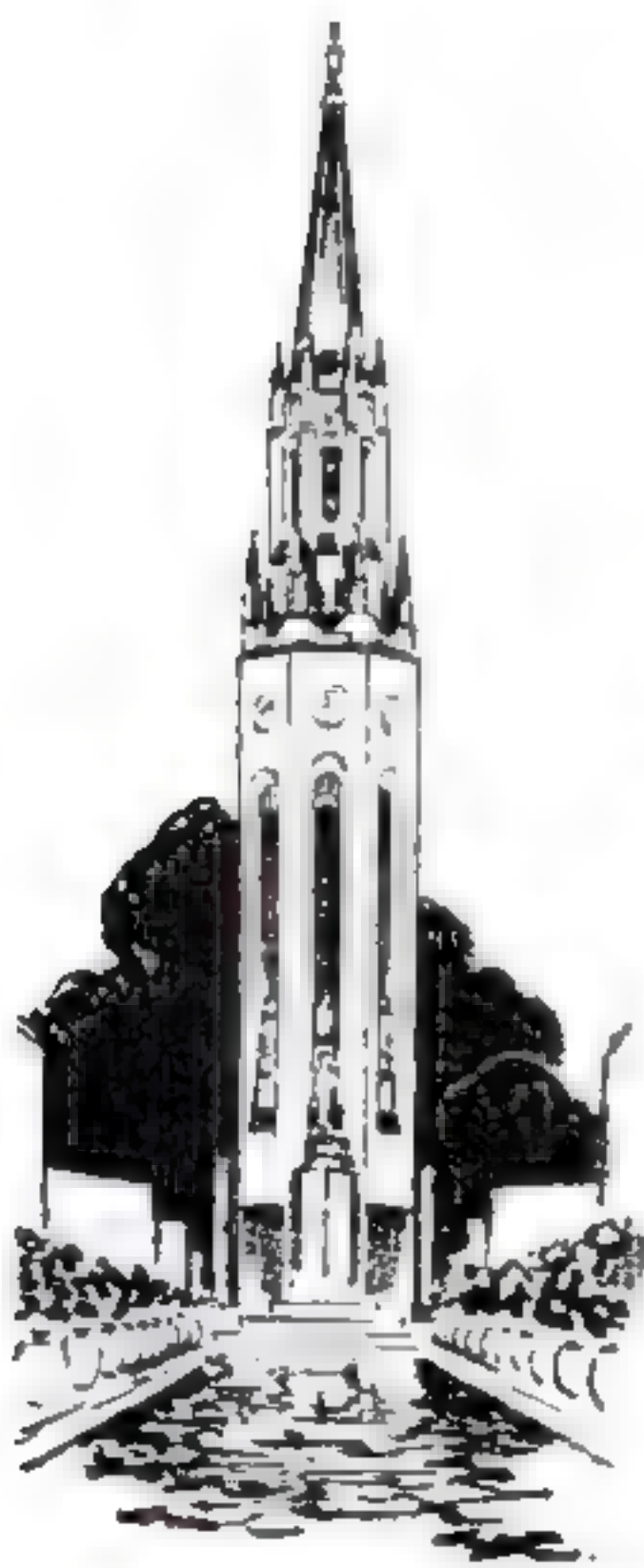
By JOHN H. WOOD

FOUR years ago a twelve-year-old boy dropped into the home workshop of Charles Henry Hunt, of Long Beach, Calif., and asked for help in carving a small totem pole. Hunt tried to stall him off, but the lad was persistent. Finally the man gave in and then found to his surprise that it was a fascinating subject. Today he is still making miniature totem poles.

Complete in every detail, these carvings are copied from au-

thentic Indian relics. It is Hunt's ambition to make a tiny duplicate of every known totem pole. So far, he has carved fifty-two of them, which range in height from 18" to 36". When the group is as nearly complete as he can make it, he plans to present the carvings to a museum.

The hardest part of making these Indian "family trees" is laying out the work. Only thirty or forty hours are needed to complete the intricate carving and finishing. He also carves miniature canoes, ceremonial masks, and similar pieces. The most interesting poles, he says, are those from



MINIATURE TOTEM POLES ARE PART OF HOME WORKSHOP CLUB'S DISPLAY AT GOLDEN GATE EXPOSITION...AND NEW YORK'S "WORLD OF TOMORROW" EXHIBITS BUFFET SET MADE BY ANOTHER AMATEUR



R. R. Foster with a few of his novel caricatures, part of the Long Beach (Calif.) Home-craftsman's Club exhibit at the Golden Gate Exposition. Note comic "totem pole" in front

give a historical note to the display, but Foster's carvings, which are in the nature of caricatures, lend a humorous touch.

On the other side of the continent, the United States Trust Company Homeworkshop Club of *New York City* is represented at the New York World's Fair by two candlesticks and a bowl made by R. A. Johnson, club president. The three pieces were turned from the burl of a totara tree, a species of pine indigenous to New Zealand, and are on display in the New Zealand section of the British Pavilion. Totara burls are very rare and when found are usually cut into pieces for distribution to museums—they cannot be purchased commercially.

The *Cuyahoga Falls (Ohio)* Homeworkshop Club has gained five members as a result of an exhibit in the window of a hardware store. Furniture, carvings, and metal work were displayed. Visitors wanted to purchase several items but were refused.

A successful exhibit was held by the Gem City Homeworkshop Club at the *Dayton*

(*Ohio*) Hobby Fair. More than 4,000 persons attended, and the display received favorable mention in newspaper write-ups. The following were exhibited by members: stagecoach, George R. Reid; duck sewing kit, pipe rack, and cigarette box, Paul and Henry Paetz; squirrel plaques, Harold Sigler; corner cabinet, end table, vase, and jewel box, Victor R. Shuttleworth; "Snow White and the Seven Dwarfs," Franklin Robeson; high chair and barrel chair, Stanley Starr; ship model, doll bed, child's kitchen cabinet, hall tree, magazine rack, and club sign, Theodore F. Herbert.

The *Ware (Mass.)* Craftsman Guild recently enjoyed a demonstration on how to make projects from copper, pewter, silver, and other metals, given by Charles O. Cook, an instructor of metal craft at Worcester. Several members displayed work they had completed, and preliminary arrangements were

Queen Charlotte Island, Alaska. The same kind of wood is used as that employed by the original Indians.

Hunt is not a craftsman by trade—he is a teacher of physical education and during the 1932 Olympic Games served on the general Olympic committee. "But my shop," he says, "gives me satisfaction way beyond that possible with any other hobby." He has made and given away at Christmas time more than 10,000 toys.

As a member of the Long Beach Home-craftsman's Club, which is affiliated with the National Homeworkshop Guild, he loaned some of his work for the exhibit that the club has in the Recreational Building of the Golden Gate International Exposition in San Francisco. Another member, R. R. Foster, also has carvings in the exhibit, but they are of a totally different kind. Hunt's totem poles



New York World's Fair visitors will see this buffet set in the British Pavilion. It was turned from a totara-tree burl by R. A. Johnson. The stars on the candles represent the Southern Cross



Alton Larson gave a talk on wall papering before the Town Hall Homeworkshop

made for the club's first public exhibition.

Programs of the *Connellsville (Pa.)* Homeworkshop Club have included a talk on glue problems by E. Daberko and a discussion of finishing and polishing wood by Joseph A. May. The club plans to make tops to give to local children.

A demonstration of a high-speed electric machine for cutting designs was given by Herbert Chapman of Grand Rapids and H. J. Kuhn, secretary, at a meeting of the *St. Joseph (Mich.)* Homeworkshop Club in the high school manual-training room. Sessions are held twice a week under the direction of J. S. Dentler, instructor. Other programs have included moving pictures, a demonstration of an electric hand grinder, and a lecture on the steel industry and the Bessemer steel process by Henry H. Hapke.

"Swap Night" was enjoyed by the South Shore Homeworkshop Club, *Quincy, Mass.*, when each member brought an article worth about twenty-five cents and exchanged it with another member. Alfred Moore has offered the use of his basement workshop for a clubroom, and plans are now being made to equip it with additional lights, workbenches, and both power and hand tools.

Gordon Hammond, vice president of the *Richmond (Va.)* Homecraft and Modelmakers Guild, in his home workshop with one of the many model gas-powered airplanes he has built



Club, *Ottawa, Ill.* G. B. Anderson presented an evening of magic at another meeting.

The *Denver (Colo.)* Homeworkshop Club held its annual dinner in conjunction with a display at the Y.M.C.A. Hobby Fair . . . Jacob Fisher spoke on repairing and refinishing furniture before the *LeRoy (N.Y.)* Homeworkshop Club . . . The merits of different kinds of home workshop tools were discussed by the Klondike Homeworkshop Club, *Mason-town, Pa.*, at the home of Calvin Fleming, president . . . Meetings of the Aquida Homeworkshop Club are held in the well-equipped shop of the president, A. F. Alexander, *Brooklyn, N.Y.* . . . The Southeast Woodcraft Club, *Cleveland, Ohio*, is conducting a membership campaign . . . Photography is being studied by the *Brenham (Texas)* Industrial Homeworkshop Club . . . A talk on joints was

given by C. W. Lingham before the Timbercraft Homeworkshop Club, *New Bedford, Mass.*

A lecture on the automobile ignition system was given by John Dillon at a meeting of the *Peekskill (N.Y.) Homeworkshop Club*. Forty-six members displayed their work in the annual exhibition . . . The uses of cutting and carving tools were demonstrated when the Hardwood Homeworkshop Club met in the workshop of Paul Steinway, *Neenah, Wisc.* . . . Colored lantern slides were shown by Martin Therriault to the *Edmundston (N.B., Canada) Hobbyists* . . . The Bailey Square Homeworkshop Club had a display in the *New Bedford (Mass.) Food Fair* . . . Members of the *Universal (Pa.) Homeworkshop Club* are making wood novelties and soap carvings, which will be sold to raise money for a club workshop . . . Jack Netsch, vice president of the Pioneer Homeworkshop Club, *Philadelphia, Pa.*, is planning a series of social events.

The timing of double-acting steam engines was demonstrated by J. A. Ogilvie when the Society of Model Engineers met at the workshop of Ben Cook, *Ottawa, Ont., Canada*. The club recently met at the home of the secretary, George B. O'Connor, to see a tryout of some of the railway equipment being constructed.

Through the coöperation of a machinery company, the Kerrisdale Homeworkshop Club, *Vancouver, B.C., Canada*, obtained the loan of a circular saw, and a demonstration was given by a local manual training instructor. A bird-house building project is being sponsored in the elementary and high schools. Puzzle souvenirs will be presented to all contestants, and the prizes will be tools. Ian B. McKay is chairman.

Garden ornaments are being made by the Way Homeworkshop Club, *Chicago, Ill.* . . . Several totem poles have been made by members of the *Waban (Mass.) Homeworkshop Club* . . . Moving pictures were enjoyed recently by the *Fall River (Mass.) Homecraft Club* . . . Meetings of the *Ridley Park (Pa.) Homeworkshop Guild* have been devoted to making corner brackets of three shelves and a drawer . . . The *Western Springs (Ill.) Craftsmen's Guild* had a treat when one of the members took them for a trip over Chicago in the plane he pilots . . . Richard Iversen, secretary of the Jumbo Homeworkshop Club, *Chicago, Ill.*, has completed a model of Fort Dearborn. He used over 2,600 matches and 8,000 tiny shingles . . . The work of high school boys was examined by the *Crestline (Ohio) Homeworkshop Guild* at a meeting in the high school shop.



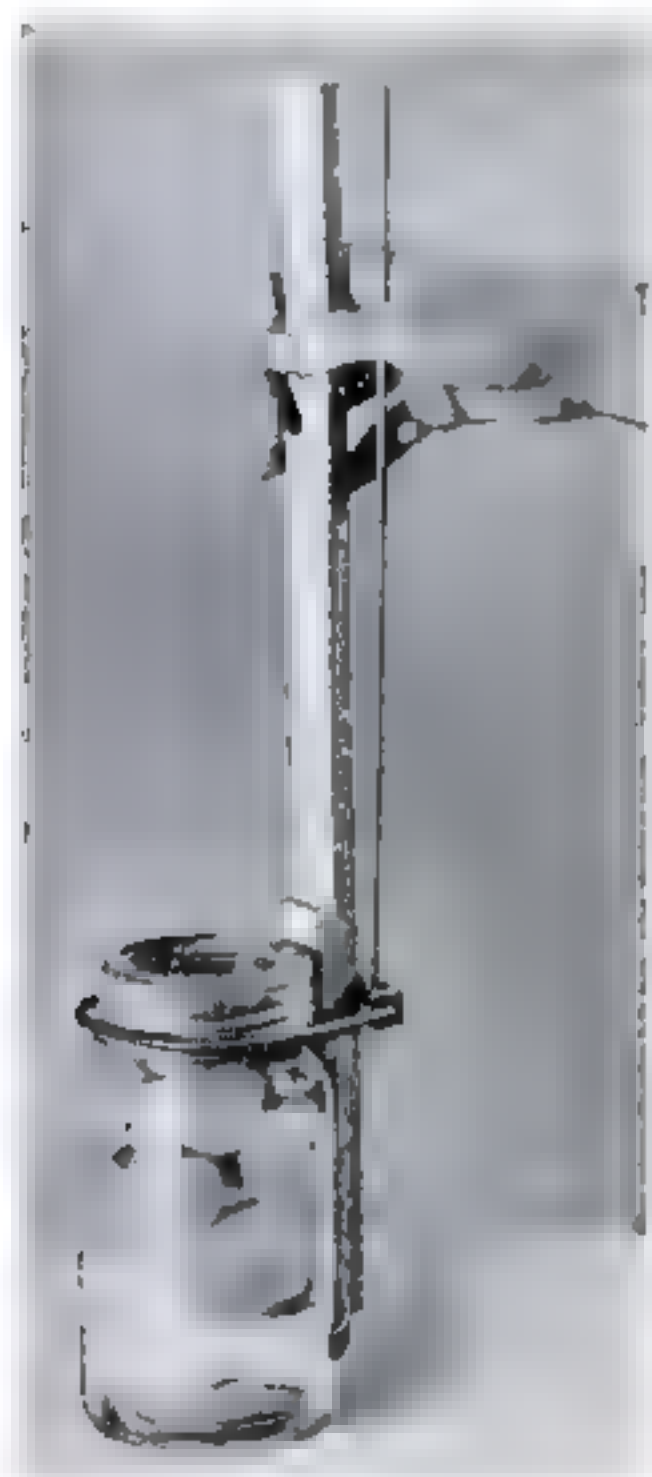
Henry J. Kuhn, secretary of the St. Joseph (Mich.) Homeworkshop Club, gives a demonstration in the manual training room of the local high school. He is using a high-speed electric tool for cutting designs

Fruit-Jar Lifters

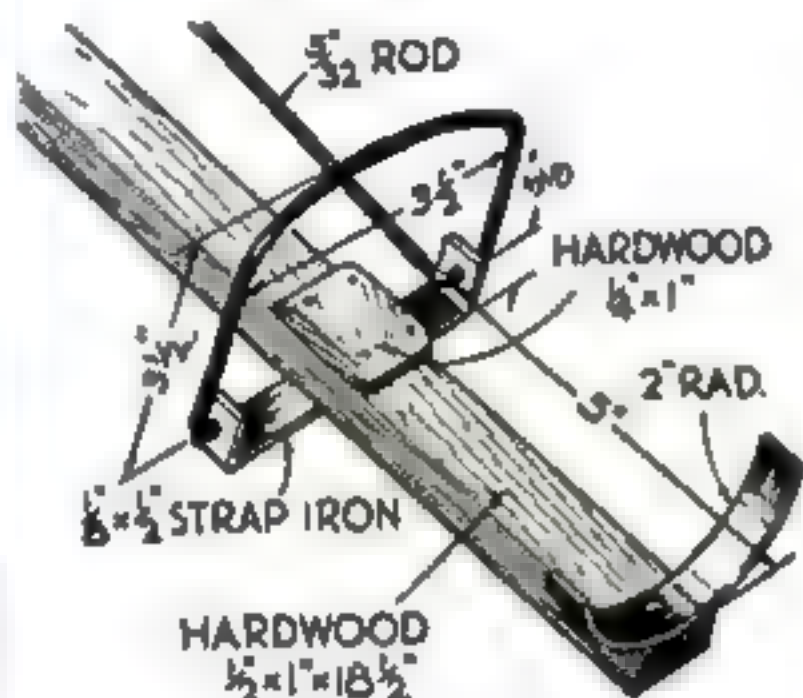
PREVENT SCALDED FINGERS

HERE are two types of homemade fruit-jar lifters to prevent scalding the fingers when the jars are removed from the boiling water.

The one shown below requires a piece of hardwood $\frac{1}{2}$ " by 1" by $18\frac{1}{2}$ ". Across the lower end is riveted a piece of strap iron $\frac{1}{8}$ " by $\frac{1}{2}$ " by 4", bent to a 2" radius. Another piece of the same material is cut about $4\frac{5}{8}$ " long, and $\frac{3}{16}$ " holes are drilled in the ends. The ends are then bent up at right angles for $\frac{5}{8}$ ". This piece is riveted across the wood about 5" from the bottom.



The gripping loop and lever is formed from $\frac{5}{32}$ " rod or stiff wire. Fit the lever side of this piece through the bracket first, later springing the other side through its hole. The small



wood block or pad which fits against the jar lid is now placed. The distance from pad to inside of the gripping loop should be exactly $3\frac{3}{16}$ ". This is the only critical dimension. When placing the loop over a jar, hold the lever and handle in a vertical position. Release the lever when lifting.

The second style of lifter, shown above, is bent to shape from 8-gauge wire. Pieces of rubber tubing are slipped over the handle and jaws to provide a safer, surer grip. The tubing on the handle should be put in place before the wire is bent. Windshield wiper tubing $\frac{9}{64}$ " in diameter will be found to fit perfectly.

Bulb Tests Photoflash Equipment

BATTERY-POWERED photoflash equipment can be tested in advance by making an adapter to fit the photoflash lamp socket. Drill a hole in an attachment plug large enough to take the socket from a discarded flash light, and cut into the parallel slots. Bend down one of the contact springs thus exposed so as to be under the socket and to make contact with the bottom of the flash-light bulb when it is inserted. Solder the socket to the other contact spring.

Another method is to mount a socket of a Christmas-tree lamp with sealing wax or similar material in the screw base from a used photoflash lamp or illuminating bulb. First solder short wires from the socket to corresponding wires that will be found in the base when it is separated from the glass bulb. Set the socket high enough to provide a good grip for the fingers.—STERLING D. FOX.



Two types of testers are shown at the left



It takes a woman to appreciate the convenience and smartness of this dressing table with stool to match

Ultramodern

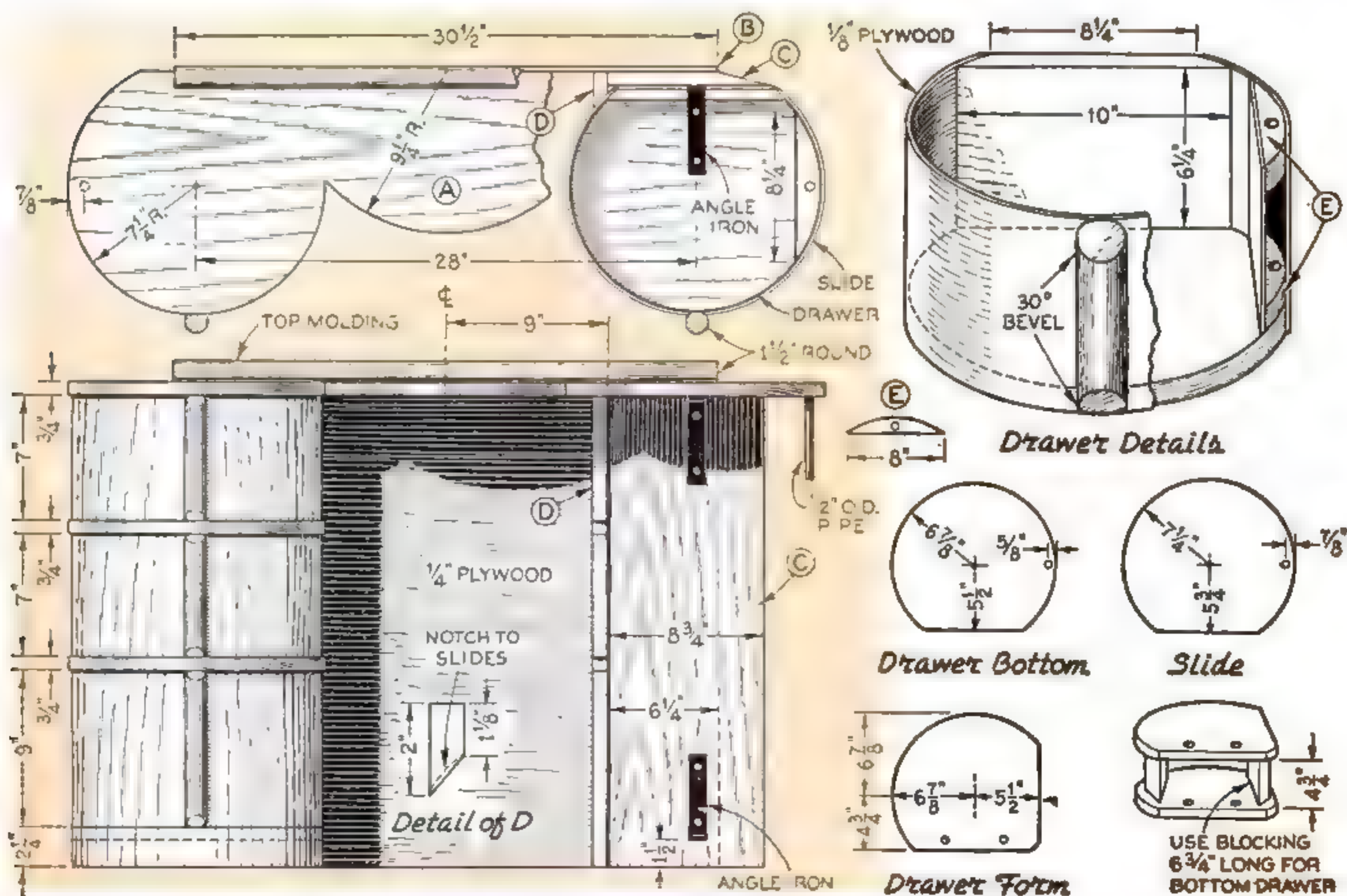
How to Construct a Unique New Type of Vanity with Six Swinging Compartments

• • •

By W. KEITH VINING

A "SWING DRESSERETTE" is what I call this ultramodern vanity. It is a piece of furniture to appeal to the woodworker who is looking for something a little out of the ordinary. The construction is simple, yet so unconventional as to make the work a pleasant variation for ordinary cabinet-making, and the finished piece is at once useful and distinctive.

After the materials given in the list at the end of the article have been obtained, start the construction with the top A, which acts as the principal form or chassis. It is cut in one piece, and two holes the size and shape of the lock nuts



Dressing Table

are chiseled into the underside near each end where indicated. The lock nuts should fit snugly in these holes and be fastened with small pieces of sheet metal so they will not drop out. The centers of these retaining pieces must be cut out for the pivot pipes. All measurements shown on the drawings from the pivot holes to the edges of the lumber are to the center of the holes.

The back *B*, of $\frac{1}{4}$ " plywood, is screwed to the top, and then the reinforcing boards *C* are placed. The two parts *D* are fastened at right angles to *C*, having been previously notched for the slides, which are the disks of wood placed under the upper and second drawers. The top steel angle braces are gained or set into *A* and *C*. The bottom angles are gained into *C* only, as they are placed under the bottom shelves.

Each of the two bottom shelves, which are same size as the drawer bottoms, acts as a slide as well as a form for the $2\frac{1}{4}$ " wide bottom apron, which should be glued to it. Fasten under each of the bottom shelves two roller casters of the type having a flat plate. Mark the intersection of the angle brace with the shelf, but do not screw the bottom shelves to the angle braces until the final assembly.

The $\frac{1}{8}$ " thick plywood which forms the outside of the six compartments is bent with the aid of a removable wood form

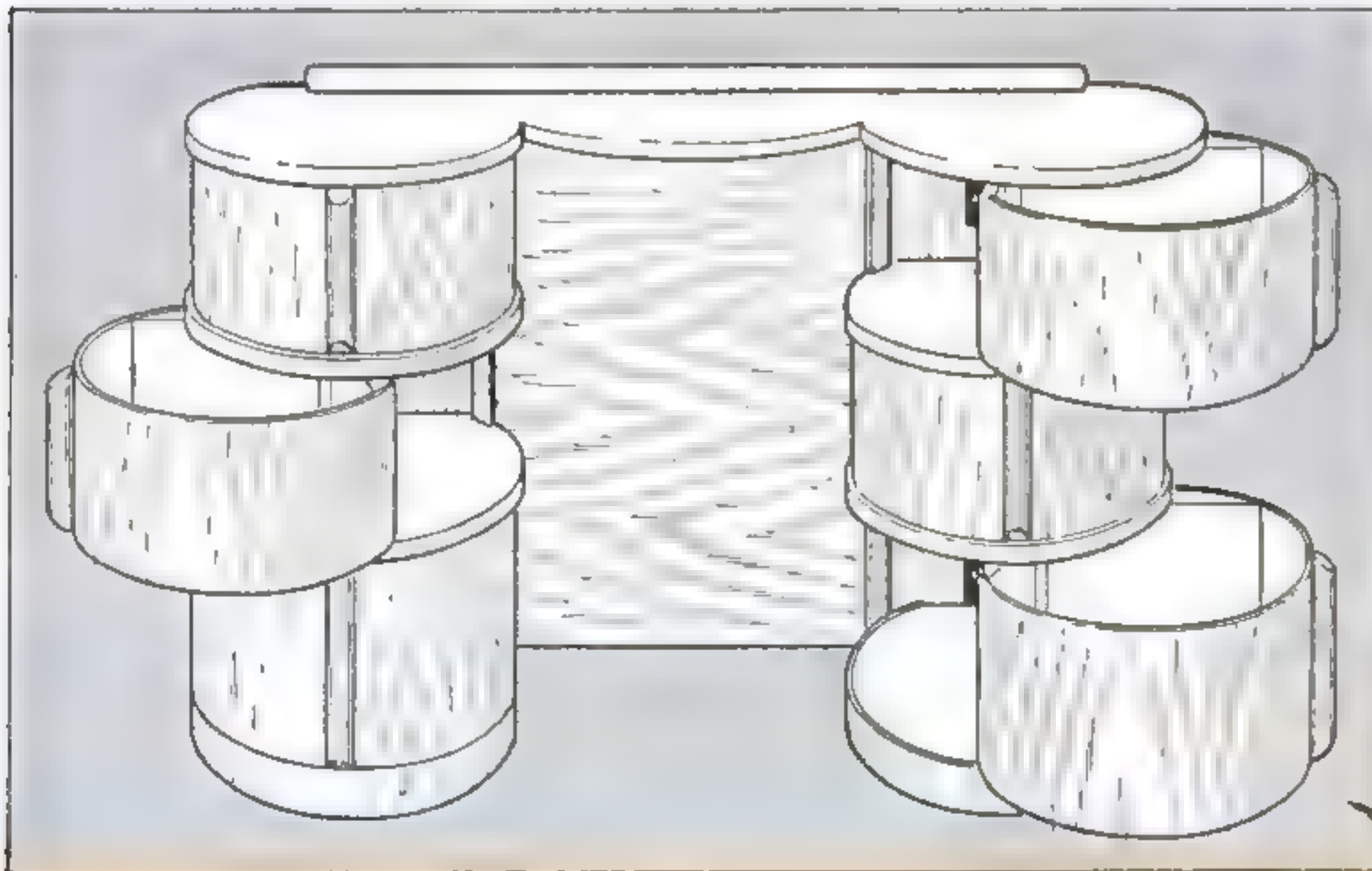


Nail the round molding along the rear edge of *A* with long finishing nails and set the nailheads. This molding is slightly flattened on the bottom. After nailing, fill the holes with plastic composition wood.

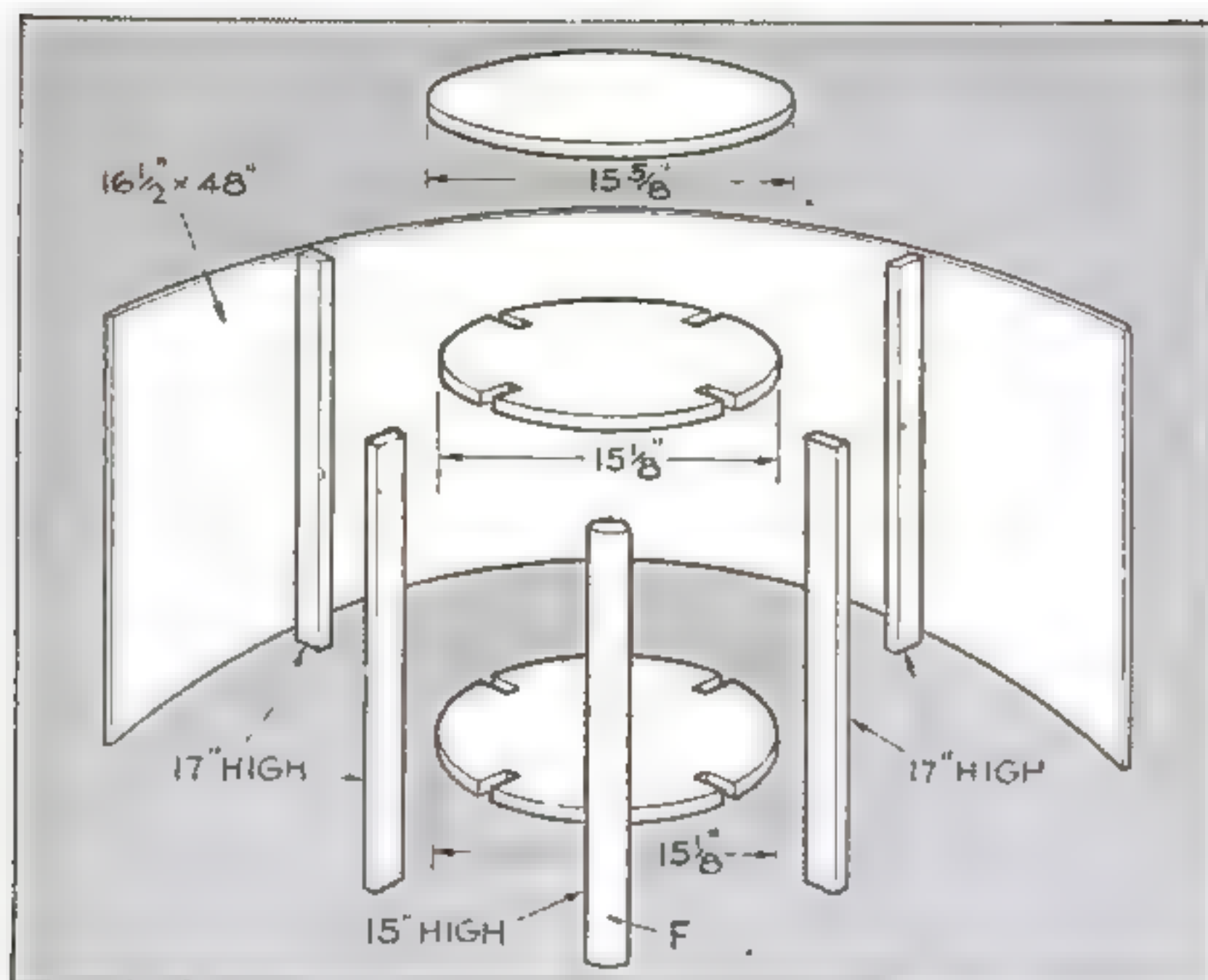
To construct the six swinging compartment or drawers, it is necessary to build a form or jig as shown. It is first used for the 7" drawers; then by substituting blocks 2"

longer, it will serve for building the bottom drawers. The holes indicated are to take the fore jaws of the clamps. The jig is used either way up, depending upon whether a right-hand or a left-hand drawer is being made.

Place a piece of the $\frac{1}{4}$ " pipe absolutely ver-



Opening wide at a touch, the compartments have many advantages over the drawers ordinarily used



Parts for the stool. The plywood ends are joined over piece *F*

tical through a hole in your bench top. It must be perfectly rigid. Fasten a drawer bottom and a drawer back together with screws through the bottom. Slide this over the pipe and place the two small blocks marked *E* and the sheet of $\frac{1}{8}$ " plywood that is fastened to their straight edges.

Now clamp the drawer form to the drawer back and, having smeared all edges that join with grade-A casein glue or some other fast-setting glue, bend the plywood covering in place and nail the ends to the drawer back. An old-fashioned belt with a sliding buckle or even a piece of soft rope is a help in holding the bent plywood until the ends are nailed. While the glue is setting, counter-sink the nails slightly and fill the holes. Fasten the handles with screws from the inside. It is just as well to give the handles a 30-deg. bevel at both ends as indicated in the side-view drawing. All drawers are constructed in the same way except that three are right-hand and three left-hand.

Make some washers out of light sheet metal to go between the drawers and the slides, as regular washers are too thick. Lay the chassis on its back and screw the pivot pipes into place. Place the drawers and the slides on the pipes, separated by washers; and follow with the bottom shelves. The lock nuts may be set to give as much resistance as you wish. Having fastened the

bottoms to the angle braces, drive screws through *D* into the slides at each intersection; then place the project on one end and from the back drive long narrow screws through the plywood backing and the uprights *C* into the slides.

The stool is easily made by following the drawings. The legs are of $1\frac{1}{2}$ " stock and are gained into the bottom rings. They project below the plywood $\frac{1}{2}$ " as indicated. The piece marked *F* fits between the two disks and is rounded slightly; and the ends of the plywood covering are nailed to it. The top is fastened with screws from the underside of the top disk before the plywood is bent around.

The vanity is attractive finished either in the natural wood color or enameled. In either case a pleasing effect may be obtained by painting the insides of the drawers a contrasting color. Of course, the entire dressing table must first be thoroughly sanded. Be especially careful to obtain a smooth, rounded edge on the drawers so that clothing threads will not catch on the wood.

LIST OF MATERIALS

$\frac{3}{4}$ " thick wood as follows: 16" by 7'8", for dresserette top and stool sections; 14" by 13'6", drawer bottoms and slides; 9" by 8", uprights *C* and segments in drawers; 2" by 4 $\frac{1}{2}$ ", uprights *D*; 1 $\frac{1}{2}$ " by 16", segments *E* in drawers and stool uprights.

Plywood: 1 pc. $\frac{1}{4}$ " by 27 $\frac{1}{2}$ " by 30 $\frac{1}{2}$ " for back and 1 pc. $\frac{1}{8}$ " by 4' by 6' for drawers and stool.

Molding and handles: 1 pc. 1 $\frac{1}{2}$ " round by 6 $\frac{1}{2}$ ".

Hardware: 4 steel angle braces 1" wide with legs 5" long; 2 pieces of $\frac{1}{4}$ " size pipe (actually about $\frac{1}{2}$ " in outside diameter) 26 $\frac{1}{4}$ " long and threaded for 1" at each end; 4 lock nuts for $\frac{1}{4}$ " pipe; 4 casters with flat plates, 2" high; scrap of light sheet metal for cutting washers; screws, nails, glue, etc.

NOTE: The 16" wide wood for the top, etc., may be glued up as necessary. The choice of wood and plywood will depend upon whether the table is to be finished natural or enameled. Any good quality wood suitable for furniture may be used.

Restoring Oilskin Raincoats When They Become Sticky

WHEN stored in a damp, warm place, the surface of so-called "oilskin" raincoats sometimes becomes sticky. If this breakdown of the oil film has not progressed too far, the coat can be restored to usefulness by dusting it with talc and hanging it in the light. Otherwise the softened oil must be removed by

washing the coat with alcohol, acetone, or trichloroethylene. A new oil film is then applied by spraying or brushing the cloth with boiled linseed oil. Pigment may be added, if desired, for coloring purposes. Hang the coat up to allow the oil to penetrate and later wipe off any surplus.



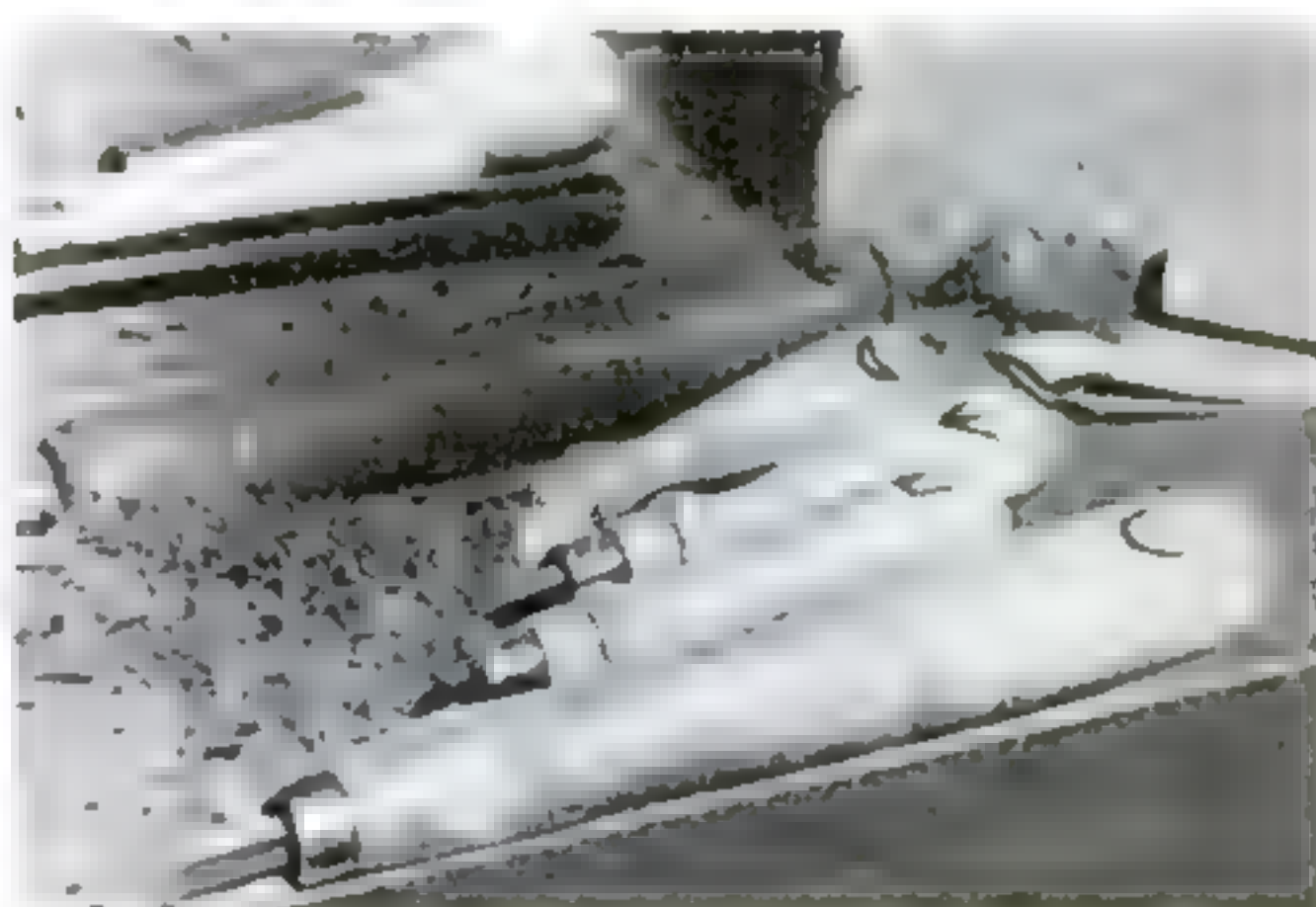
Rain and dirt cannot reach the clothespins kept in this modern bag. The slide fastener is seen at right

Moistureproof Clothespin Bag Fitted with Slide Fastener

CLOTHESPINS kept in this weatherproof bag will not cause stains when used to hang up clothes. An 18" length of oilcloth is shaped to fit over an ordinary clothes hanger and a 3" wide strip is inserted between the front and back pieces, and tapered to the top. A slide fastener is fitted into the opening, and the raw edges are bound with bias tape.

Marks on Handles Identify Wood-Turning Chisels

A COMMON practice of wood turners is to lay the assortment of chisels they require for a particular job on the bench ahead of the lathe, but the accumulation of wood shavings and chips often conceals the chisel points. That makes little difference if the handles of the chisels are marked as shown to indicate the shape of the points. The marks may be either painted on or burned in. If there are different sizes of the same shape, use marks of different sizes or, better yet, add a numeral, as 1, 2, or 3, to indicate the respective sizes.—EDWARD J. HOBERT.



Although the points are buried in shavings, the chisels are recognized by appropriate markings

SIZES OF HOUSEHOLD FUSES

[ELECTRICAL]



In the average dwelling the main fuses in the service switch are 30-ampere since they have to carry the entire load. Submain fuses in meter cabinets or sometimes in open cut-outs below the meter are usually 20- or 25-ampere and carry the load on that meter. Branch fuses for individual circuits should never be over 15 amperes unless special wire has been installed of larger than usual size. The No. 14 wire used in ordinary branch circuit wiring cannot safely be fused over 15 amperes.

POPULAR SCIENCE MONTHLY SHOP DATA FILE

TARGET ARCHERS WILL LIKE THESE

And the Novel Methods by Which They Are Made Can Be Used in Constructing Many Other Types of Boxes

By
**ALFRED P.
LANE**



INSPECT the archers' equipment at any archery tournament and you will marvel at the bewildering variety of arrow cases on display back of the shooting line. Nearly all of them—perhaps ninety percent—will be homemade, and they will range all the way from a crude box knocked together out of packing-case lumber to elaborately inlaid examples of the amateur cabinet-maker's art.

Don't make the mistake of designing a case to hold too few arrows. As a general rule, a man archer prefers a husky type of arrow case that will stand plenty of rough handling. A woman is more likely to want a light and attractive case.

The two arrow cases illustrated side by side on a fol-



A catch is pushed backward to permit the arrow rack to drop into the case

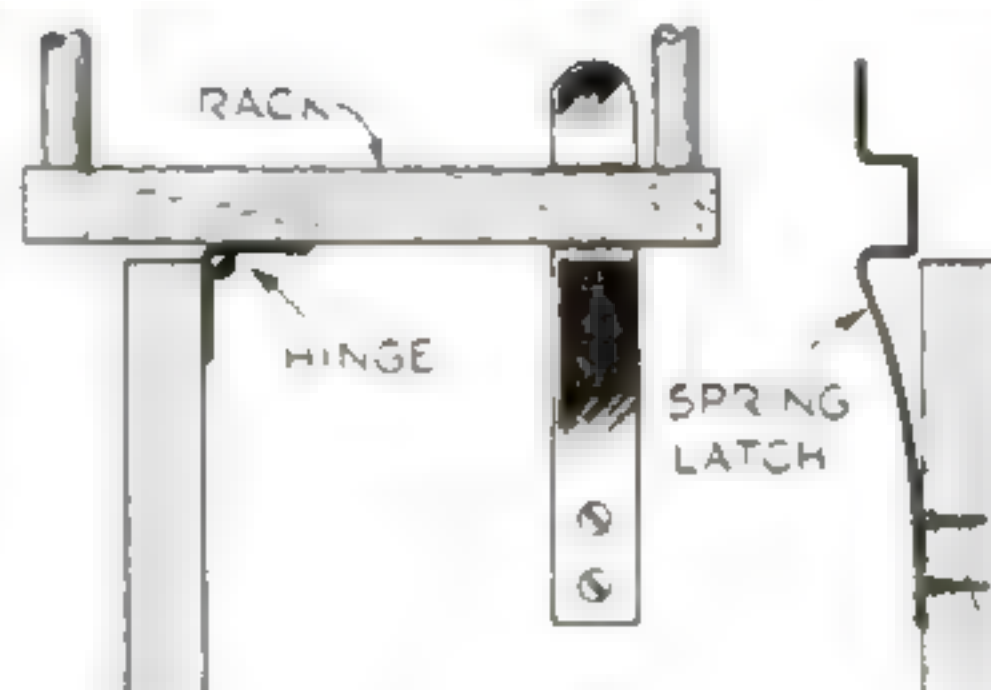


Below, light walnut strips form the corner supports of the woman's arrow rack

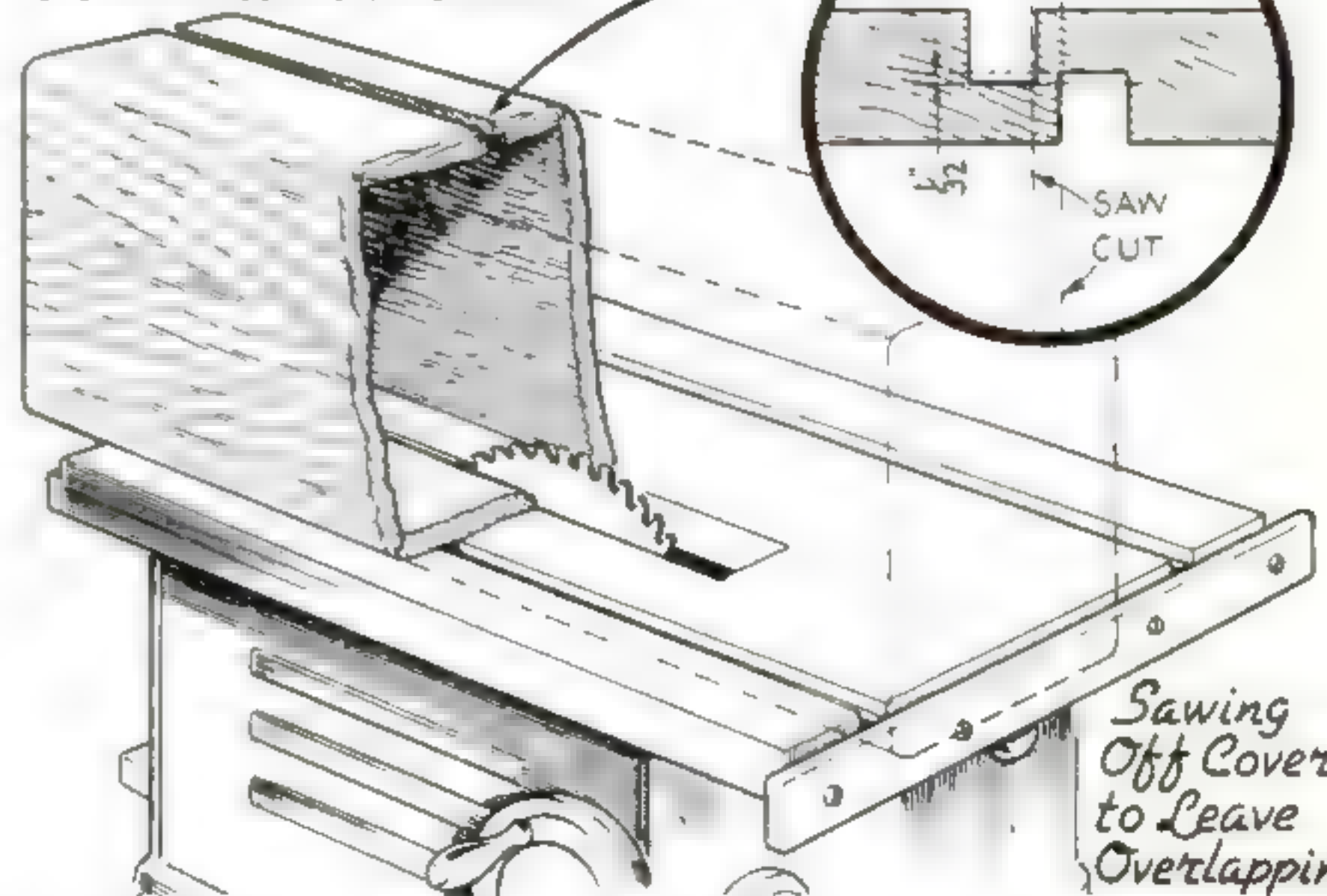


Following page represent the two extremes. One is made of solid $\frac{1}{2}$ " thick walnut lumber. It holds twenty-five men's arrows and in the front compartment all the rest of the archer's equipment, except, of course, the bow. It weighs, ready for the road, close to 15 lb. The other case holds twenty arrows and all the equipment for a woman archer. It weighs less than $4\frac{1}{2}$ lb. with everything in it. This case is made from special molding and walnut veneer plywood slightly less than $\frac{1}{8}$ " thick. In spite of this featherweight construction, the case looks substantial, is remarkably strong, and will stand many years of hard use.

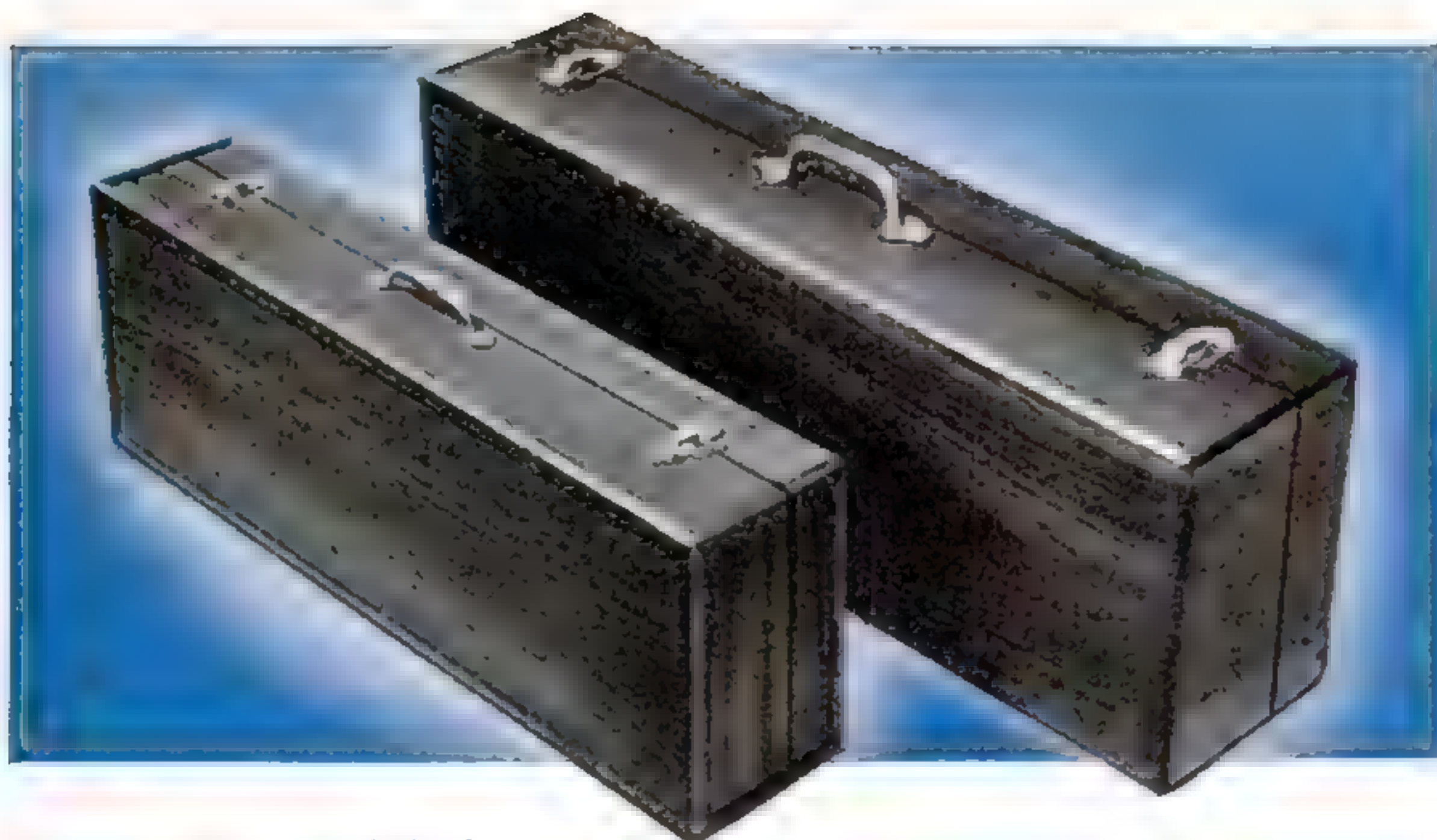
Either of these cases can be made with the aid of a small power saw. Dado cutters will speed the cutting of the edges of the $\frac{1}{2}$ " boards for the heavy case, but lacking them, the same result can be attained by making a number of cuts with the regular saw blade.



Latch to Hold Arrow Rack Vertical



Grooves are cut in the front, back, and end boards of the man's arrow case as shown in the circle. This enables the top to be sawed from the main part of the box in such a way as to provide an overlapping joint



The woman's case and the heavier, more rugged case for men's arrows



Molding



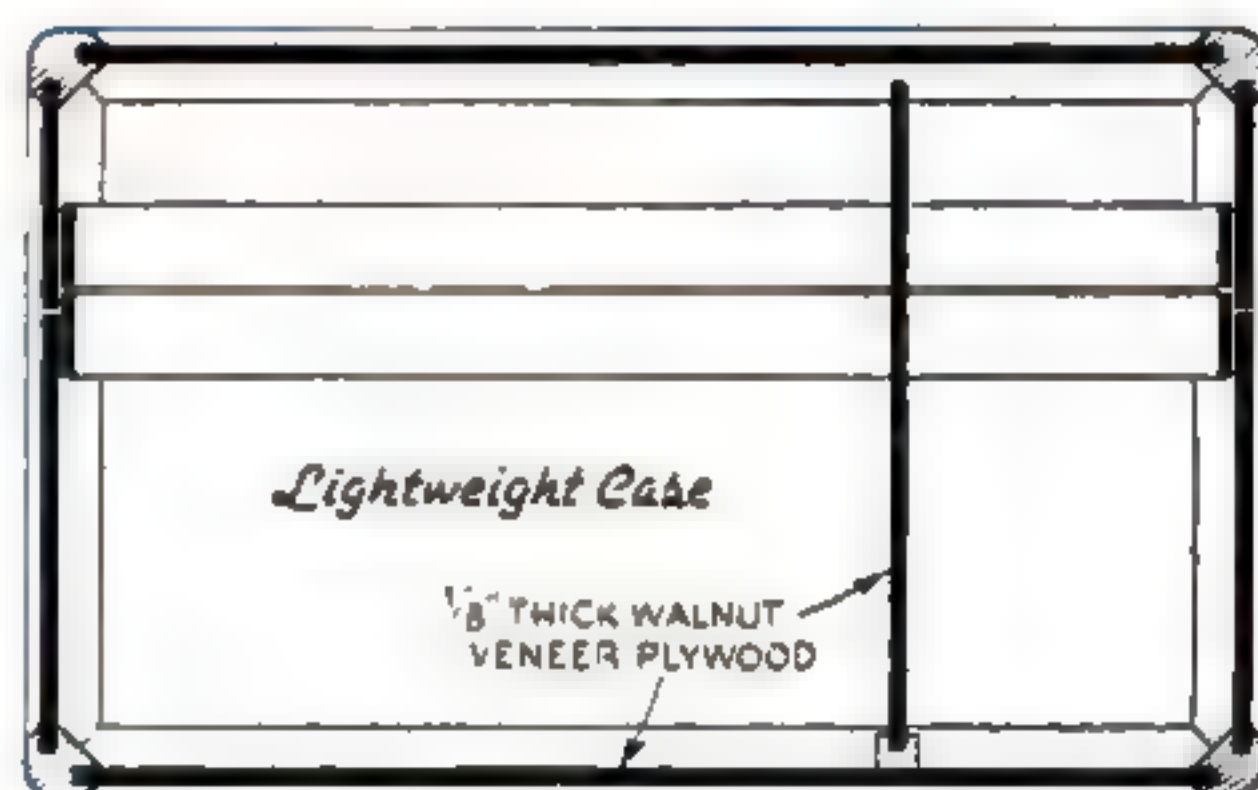
Section

It is common practice in the construction of wooden cases to glue the box together as a solid unit and then saw it in two to form the case and its cover. This method assures that the cover will fit the box perfectly. In the construction of the solid walnut arrow case, a new method was used that has proved a novelty to a number of experienced woodworkers.

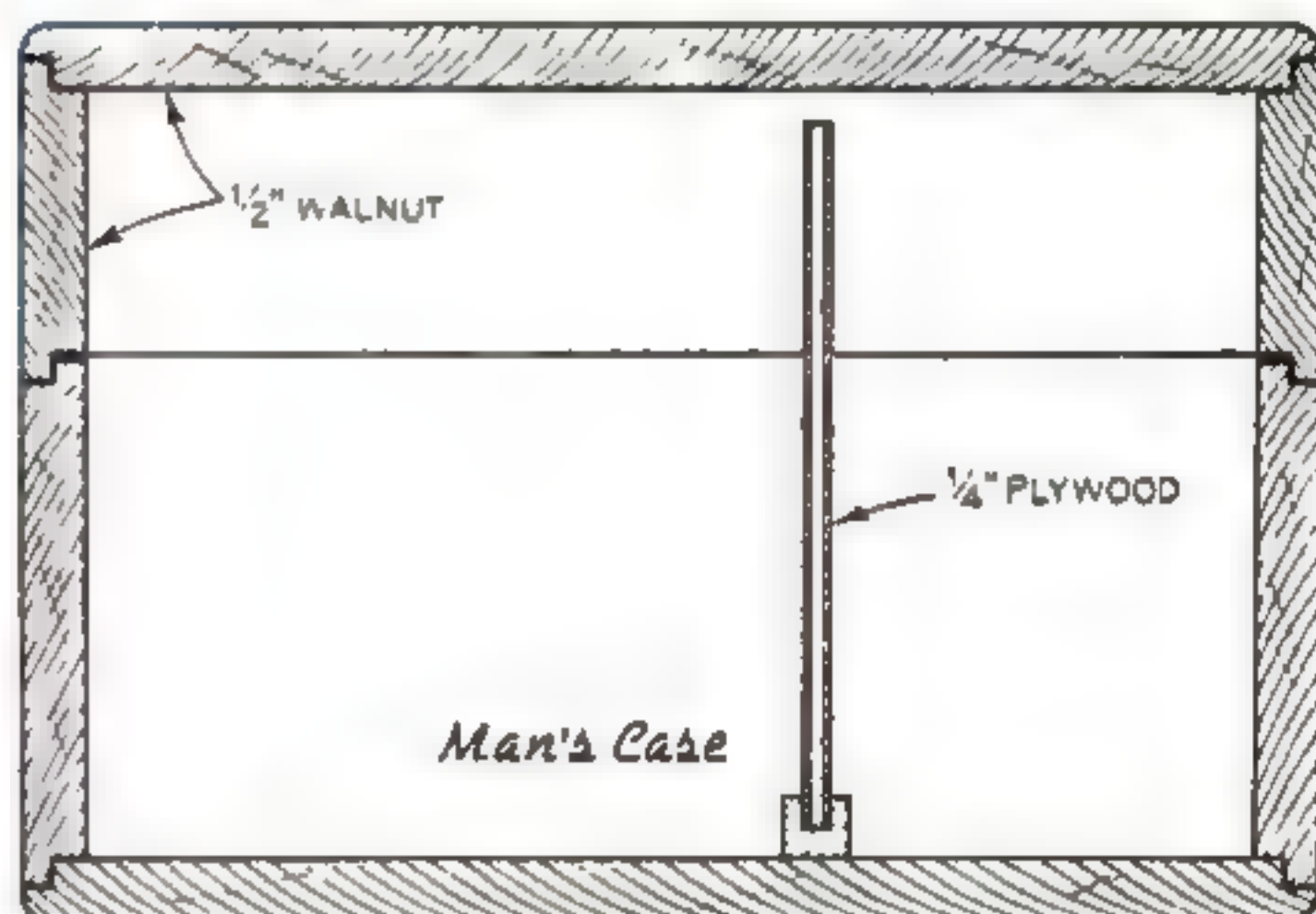


Ordinarily, when you saw a solid box apart, you have to content yourself with a flat joint between the top and bottom, yet it is much better to have a rim on the cover which seats over the edge of the projecting rim of the case. This greatly adds to the strength of the case, and in an arrow case is of special importance. It makes the case virtually insectproof so that moths or other insects cannot crawl in and make a meal of the feathers on the arrows, and it also prevents water from entering the case in the event of a sudden downpour.

This overlapping edge is easily obtained by the method shown in one of the drawings. Before the case is glued together, two grooves are dadoed (or sawn with several cuts) into the front, back, and end boards. These are spaced the width of a saw cut apart so that when the final saw cut is made right through the box, it leaves the lip on the top ready to drop into the recess in the upper edge of the case. It is necessary, in making these cuts, to get them accurately placed; and before you glue the case to-



A sectional view of the smaller case and, above, detail of the molding. Inside dimensions, for 23" arrows, are 4 1/2" by 7 1/4" by 24"



Cross section of the larger, solid walnut case. Inside dimensions, for 28" arrows, are 5 1/2" by 8" by 29 1/2"

gether, mark exactly where the parting saw cut is to come.

In working out this construction, be sure to allow extra height inside the case as glued together to allow for the decrease in inside height when the top slips down into place on the case. Also be sure to make the grooves so that their bottoms overlap at least 1/32". This will give an easy fit to the top.

Another novelty introduced into the construction of the heavy arrow case is in the making and fitting of the arrow rack. The partitions with the spacing holes are supported above the base by arrow shafts glued into holes in the corners so that at first glance the arrows look as though they are holding themselves in place. The arrow rack swings out on a hinge and locks into the vertical position with a spring latch. Allow an extra $\frac{5}{8}$ " in the length of the arrow case in addition to the thickness of the base and the length of the arrow if you incorporate this swing-out feature to allow the lower arrows in the rack to clear.

It is impossible to give exact inside dimensions because of the variation in arrow length and in the quantity and size of equipment the archer desires to carry.

The molding used in the construction of the light arrow case is much easier to make than



So lightly built is the woman's case that it weighs less than $4\frac{1}{2}$ lb. with arrows and other equipment



its appearance would indicate. First run off the necessary length and number of $\frac{1}{2}$ " square strips. Then cut the two grooves (using the same saw or dado setting for both) wide enough so that the plywood is an easy fit. That will leave room for the glue or cement, and you won't split the molding in assembling. Next set the saw for a 45-deg. cut and remove the corner between the slots and bevel the outer edges of the slots. Mitering the ends of the molding must be accurately done if you want the corners to come together without gaping. Finally, cut the plywood panels to size.

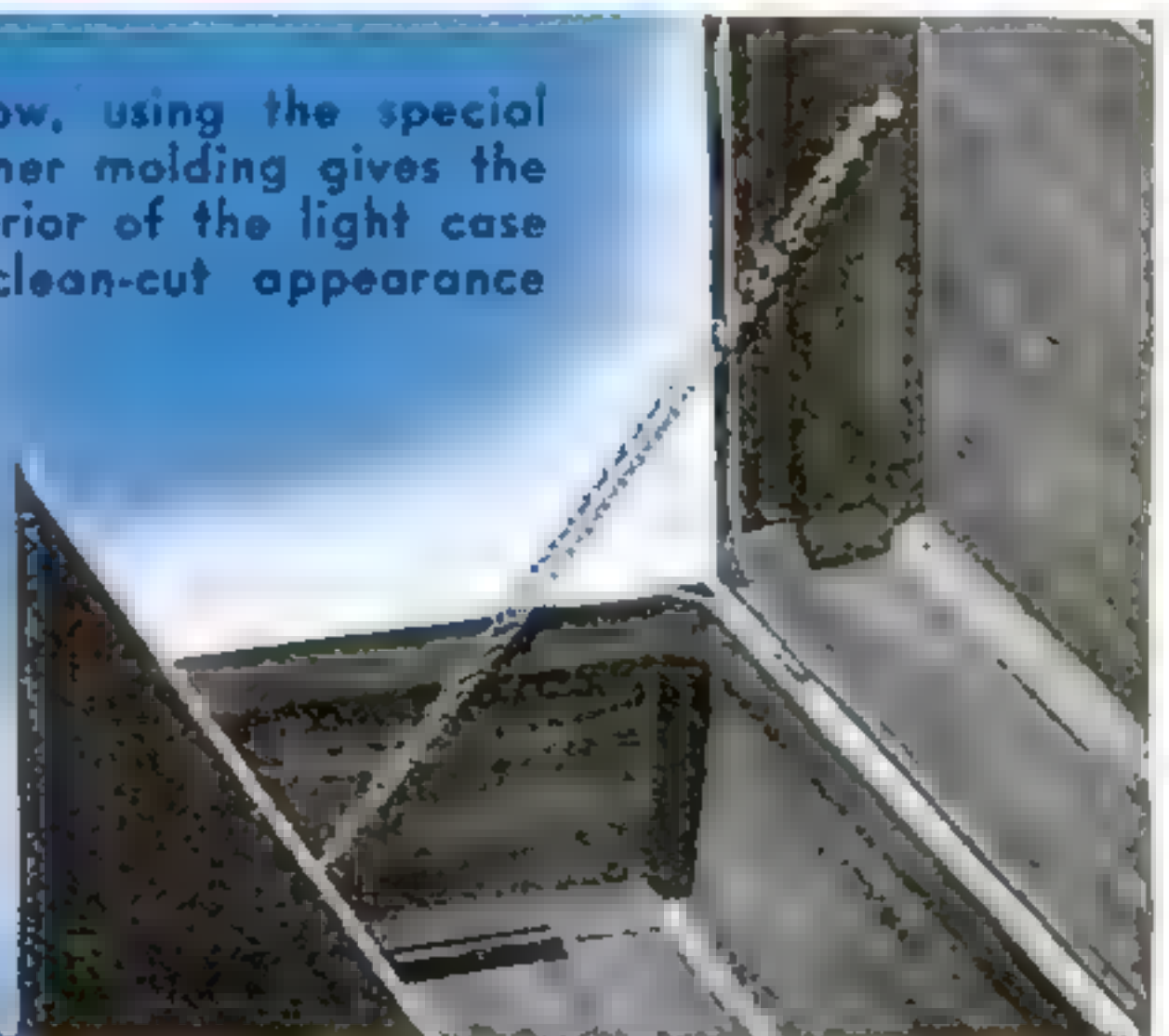
To assemble, put glue in the slots of the molding and on the ends, set the parts together, and tie the case tightly in every direction with string or heavy rubber bands.

After the glue has set, saw the top off and then glue strips of plywood along the edges to form the overlapping joints as shown.



The woman's case, upper view, holds twenty arrows; the man's case, twenty-five

Below, using the special corner molding gives the interior of the light case a clean-cut appearance



Flyproof Folding Cupboard

**HOLDS
CAMPERS' FOOD**

12", and round the edges and corners slightly. So far as strength is concerned, $\frac{1}{8}$ " wood is sufficient, but it is easier to drive tacks into $\frac{1}{4}$ " material. White pine or basswood are preferable. Tack the top shelf in position first, spacing the others below it by careful measurement. The lower shelf should be of $\frac{1}{2}$ " material.

Make stiffeners for the bottom of the door flaps as shown. Notch the stiffeners enough to allow passage for the slide fastener. Staple a small D-ring to the center of the bottom, to which can be tied the short cord attached to the tab of the fastener. Four other D-rings should be sewed to the back corners of the cover for convenience in lashing the cupboard to prevent too much sway in windy weather.

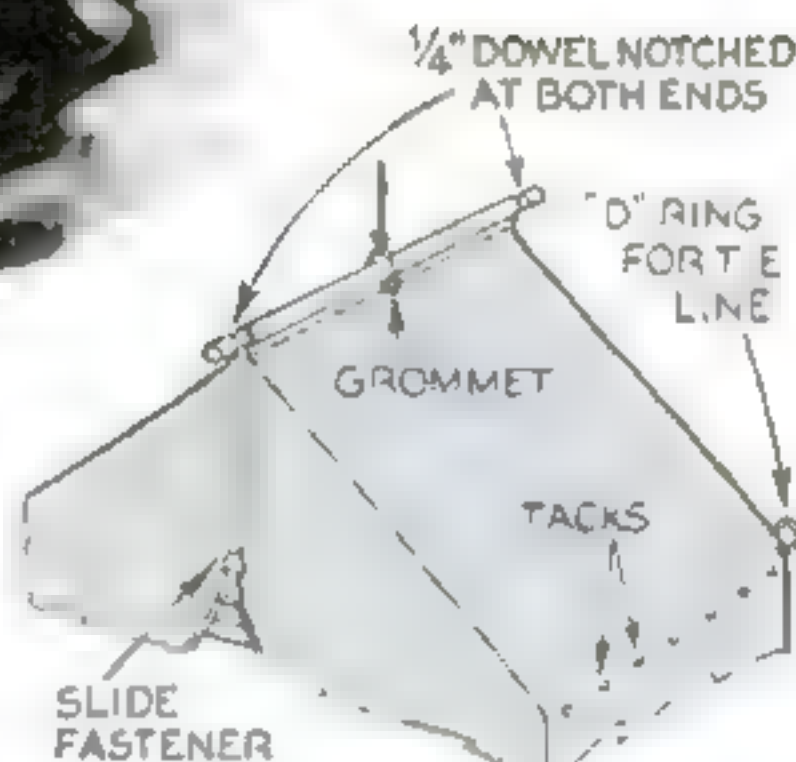
Unless the material used is waterproof, it should be treated by any standard waterproofing process. The shelves should be varnished or enameled.—J. H.

A lightweight cupboard for holding perishable supplies

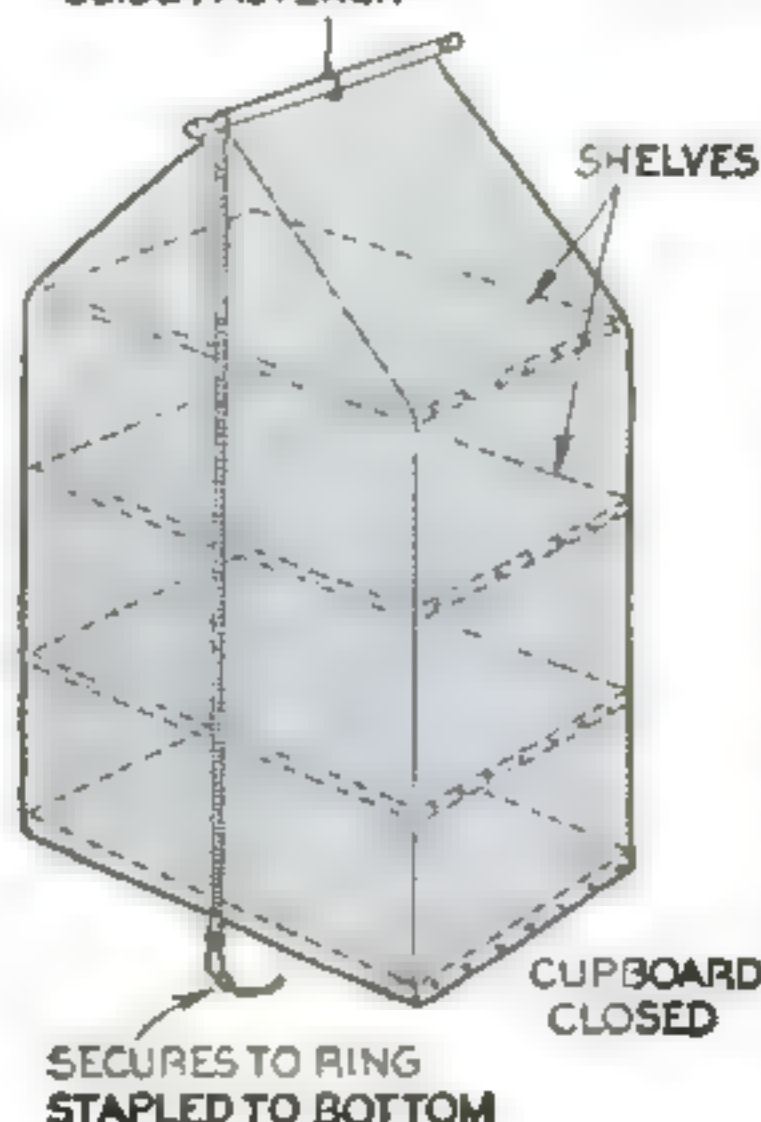
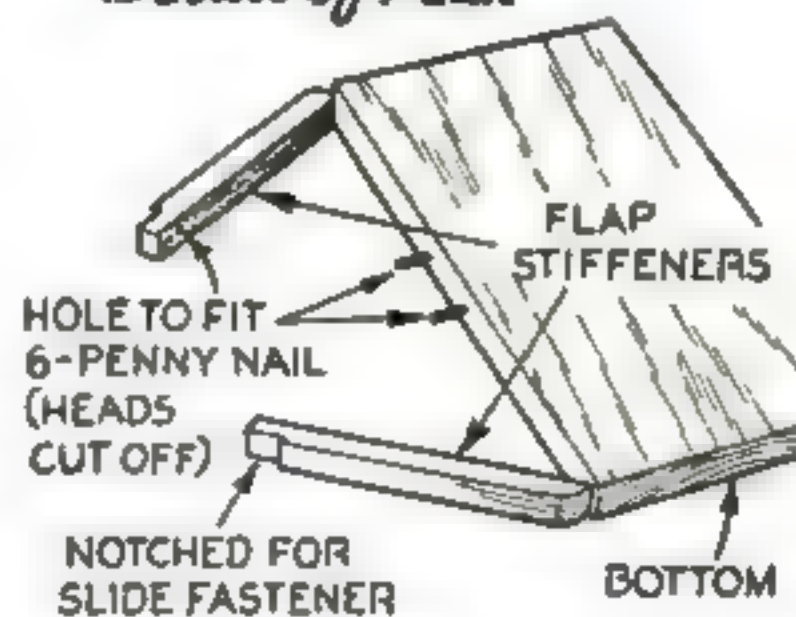
CAMPING, even at the best season, almost always necessitates outwitting the fly, the punkie, and the "no-see-em." Two dollars, perhaps even less, will buy the materials for this flyproof cupboard, which weighs less than 3 lb. and folds flat as the proverbial pancake. While only the more easily spoiled foods are intended to be stored in it, there seems always to be space for such other items as shaving gear, flash lights, films, spare ammunition, matches, and other small articles.

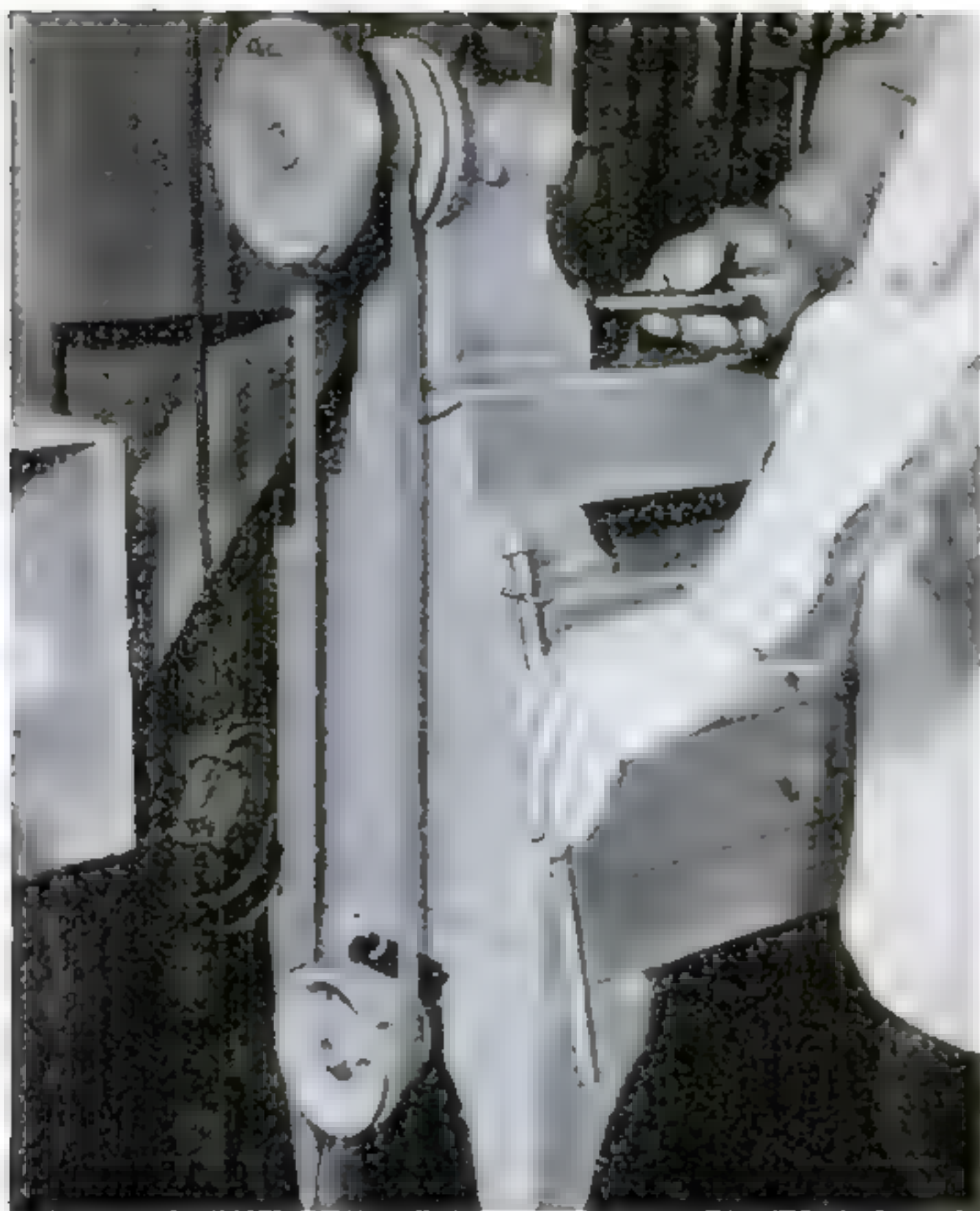
Purchase a yard of balloon silk, drilling, unbleached muslin, or canvas, and cut the material as in the diagram, leaving $\frac{1}{4}$ " for seams. These should be inside, either plain or French. When joining the sides at the peak, use the extra length to form a sleeve to take the $\frac{1}{4}$ " dowel, and allow $\frac{1}{2}$ " of double-thick material below the dowel through which to drive the No. 0 grommet for the suspension cord. Sew a 30" slide fastener the length of the flaps.

Now cut the shelf material, approximately $\frac{1}{4}$ " by 6" by



Detail of Peak





Push Rod for Wood Lathe Kept Handy in Holder

A WOOD turner can save having to hunt for the push rod every time he wishes to change attachments in the hollow spindle of his lathe by making a holder from a piece of strap iron $\frac{7}{8}$ " by 3" by $\frac{1}{8}$ ". Cut a U-shaped slot in one end $\frac{3}{4}$ " deep and $\frac{9}{16}$ " wide, bend the two prongs up a trifle, and fasten the holder on top of the lathe bench as shown above. A 12" by $\frac{1}{2}$ " bolt forms a suitable push rod.—F. H.

Pivoted Wooden Doorstop Works Automatically

WHEN a door will not stay open by itself, it is customary to use a weight, a doorstop, or a wedge to hold it, but it is then necessary to stoop down and move the weight or free the door each time it is closed. That may be avoided by using an automatic door holder of the type illustrated. The door itself pushes the holder from one position to the other, and the tension may be altered by adjusting the screw. If something more decorative is desired, a cut-out design may be mounted on the holder.—R. R.

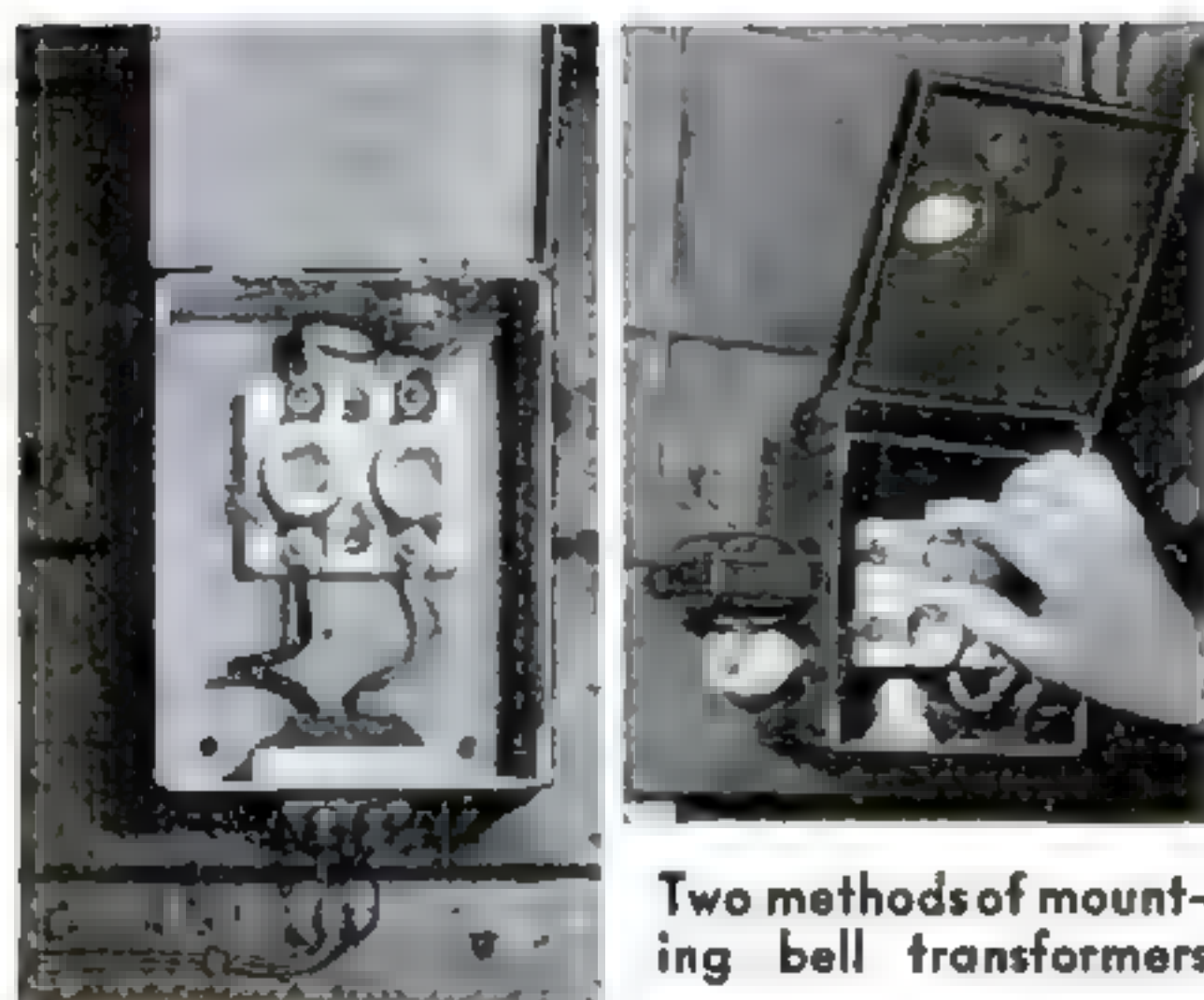


Wax Preserves Rubber Gasket

DETERIORATION of the soft rubber gasket used around the doors of various refrigerators can be prevented by cleaning the rubber thoroughly and then applying paraffin, beeswax, carnauba, or any highly refined wax containing no solvent. Rewax at intervals.—C.N.S.

INSTALLING BELL TRANSFORMER

[ELECTRICAL]



Two methods of mounting bell transformers

A bell transformer preferably should be on a separate circuit fused at 3 amperes. Fasten it on a metal box or at least keep it away from any wooden surface by mounting it on porcelain knobs or asbestos as it may sometimes get hot. One photo shows an ordinary transformer bolted to a metal cabinet with the wire carried through a porcelain fitting to the fuse block. The other shows a special cabinet with built-in transformer. Use rubber-covered bell wire rather than single cotton-covered wire. The wiring from the 110-volt supply to the transformer should always be No. 14 wire, connected to the circuit in an approved manner.

POPULAR SCIENCE MONTHLY SHOP DATA FILE

Hardware Cabinet

MADE WITH Coffee Cans



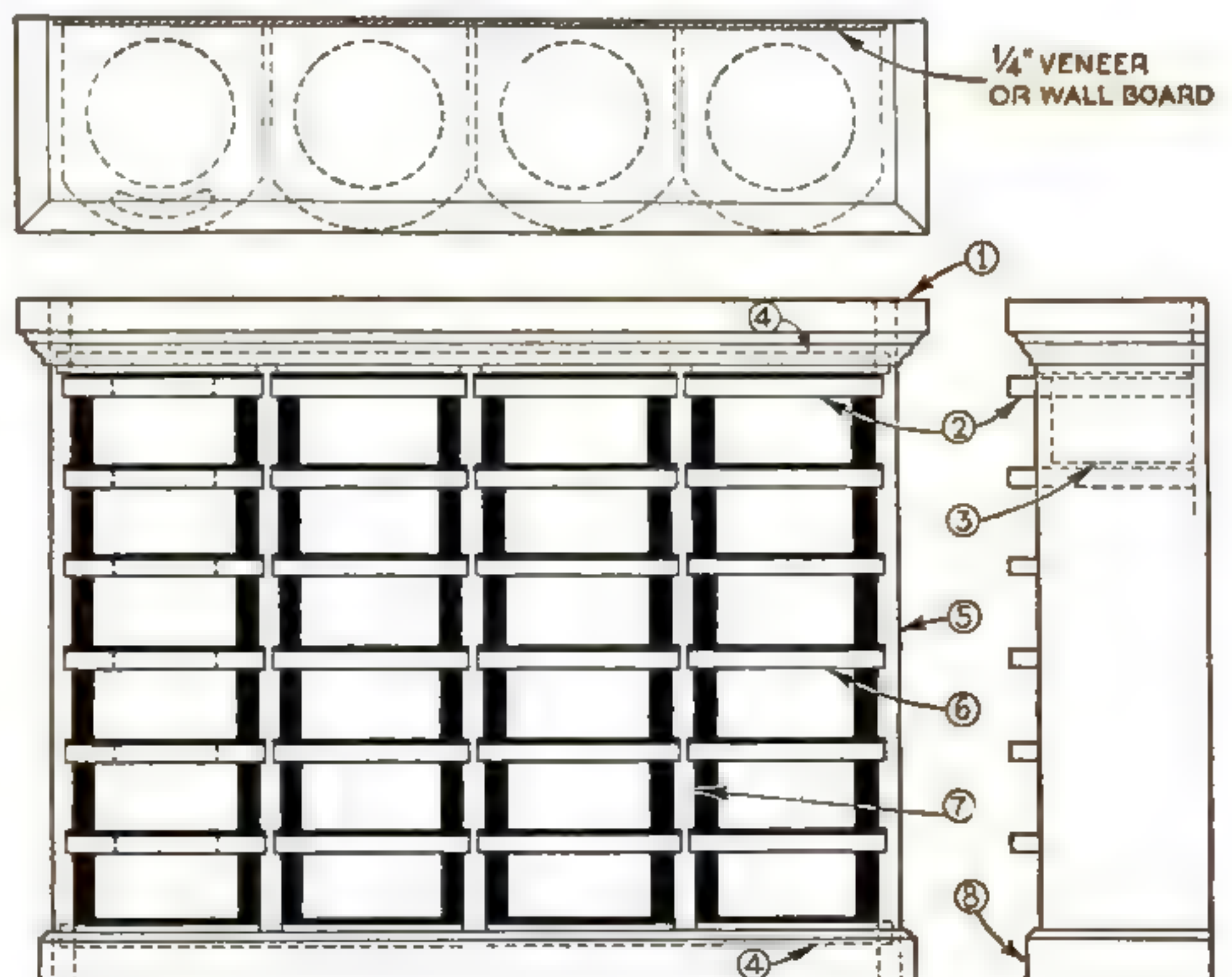
Twenty-four standard size coffee cans serve as the drawers of this shop cabinet. Each can is fastened to a wooden top or slide

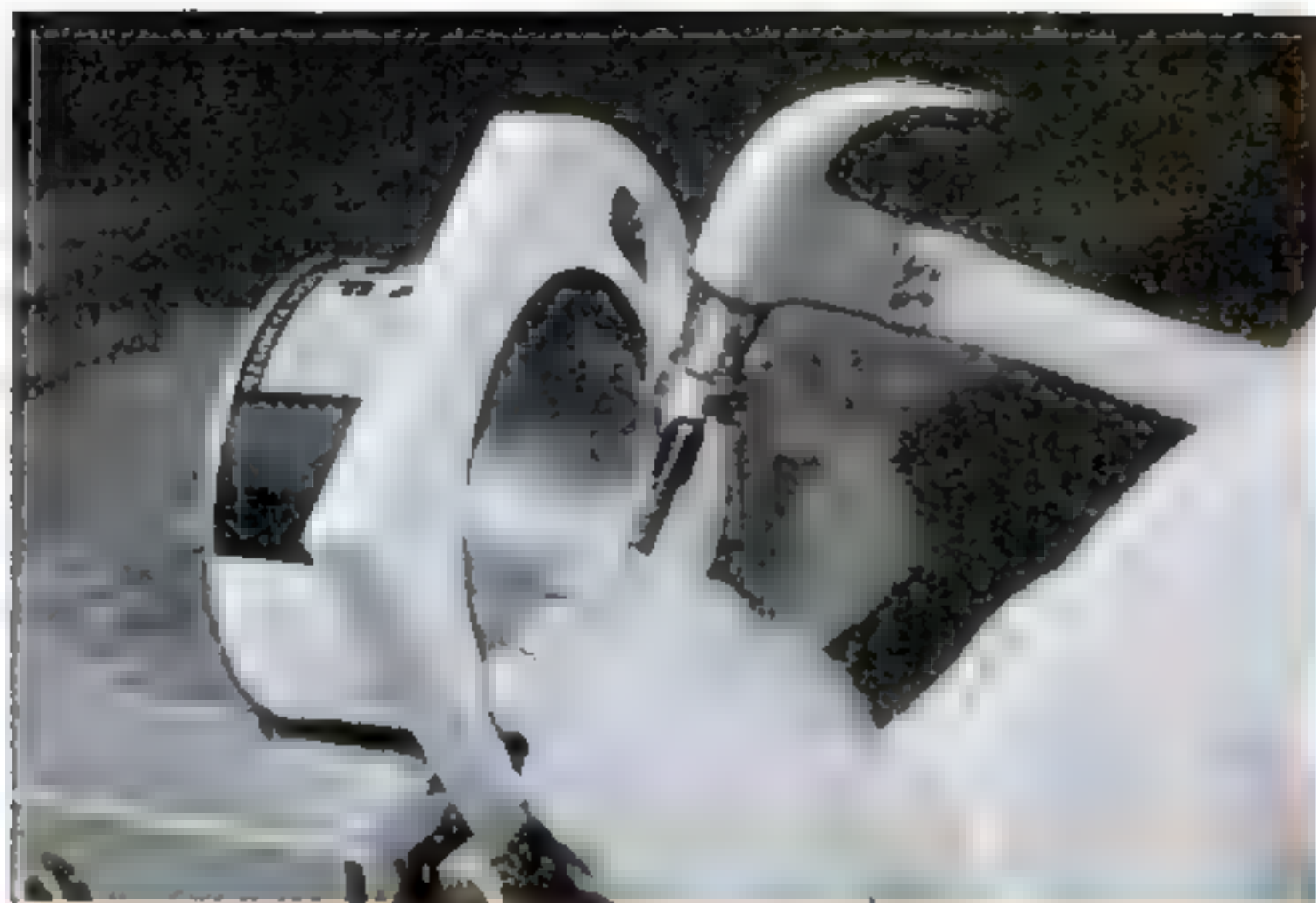
COFFEE cans make excellent drawers for nails, screws, and other odds and ends in the workshop. Twenty-four cans are used in the white-pine cabinet illustrated, but the size could be increased if desired. In planning the grooved slides for the drawers, allow upwards of $\frac{1}{8}$ " for clearance because painting will reduce it. If a dado saw is not available to cut the grooves, plan the cabinet to have cleats on the inside of the ends and partitions; these will serve the purpose.

In cutting the stock for the drawer tops (2), have the grain run across the drawer. When one of these pieces has been laid out, much time may be saved by nailing four or six pieces together and sawing them at one time. If the work is to be cut on a band saw, cut in from the side and proceed to saw as illustrated. The outer cut will have to be filled later with a thin strip of wood. After cutting the drawer front round, it is well to sand the surface so that all fronts will be uniform, and time is saved by sanding all at once. The

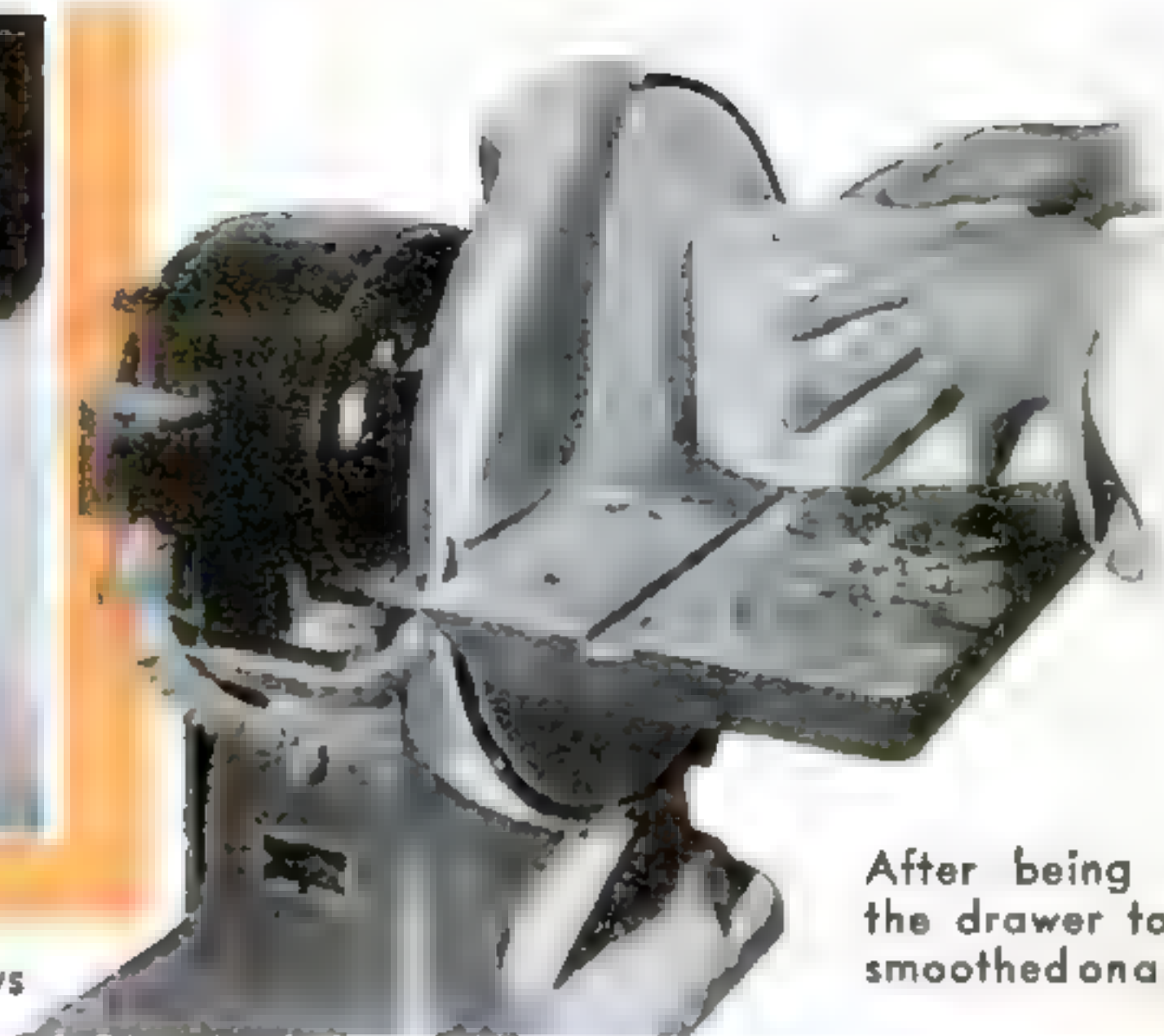


The quickest way to cut the tops is on a band saw, if available. Below, the assembly drawings





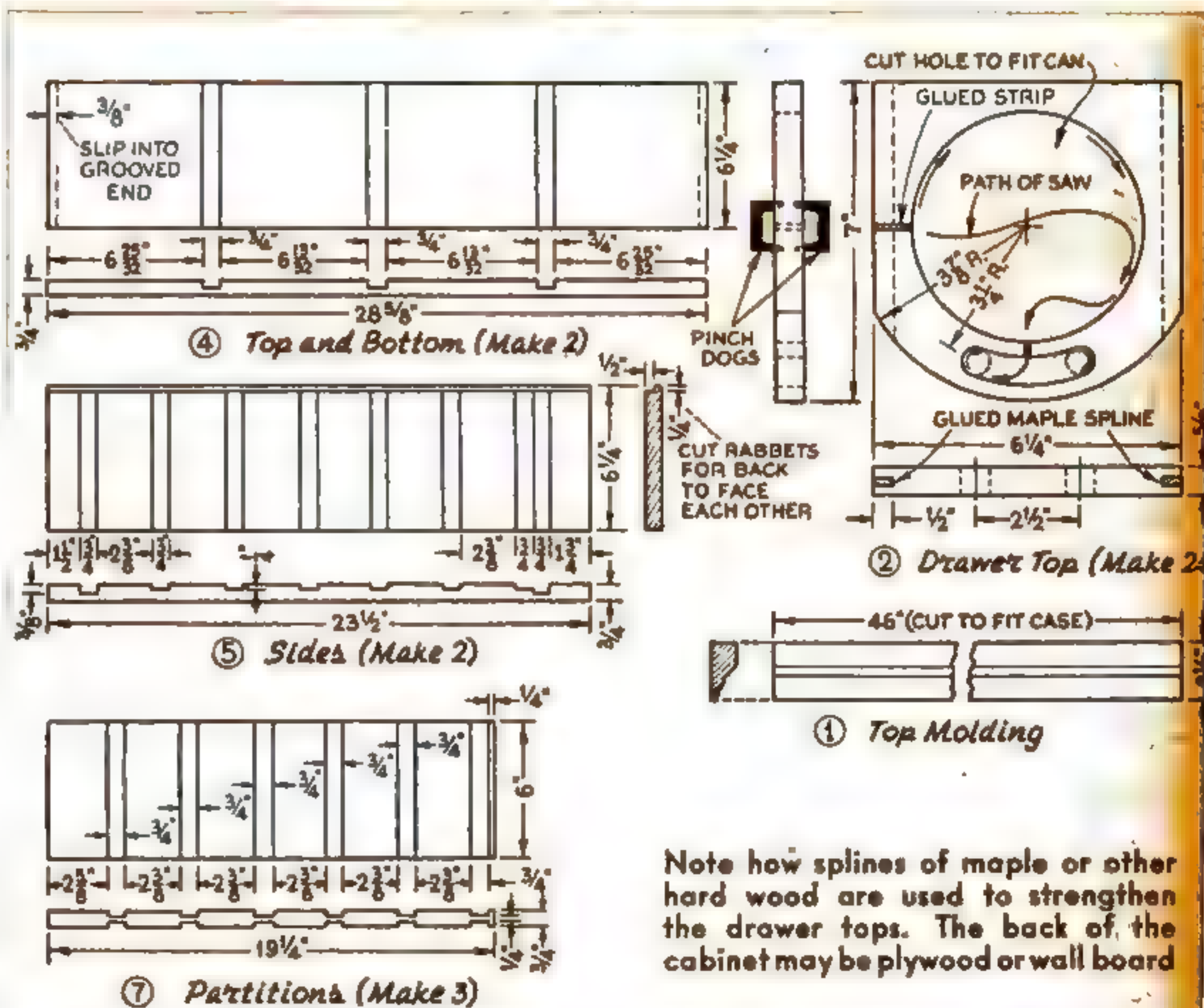
Holes are punched before fastening cans with screws



After being sawed, the drawer tops are smoothed on a sander

edge may be grooved, and a strong strip or spline of wood glued in for extra strength. If, however, the drawer tops are made from plywood and cut on a jig saw, this procedure will not be necessary.

Before the standard size coffee can will fit in these tops, it will be necessary to remove the top band of the can. Grasp the band with a pair of pliers and give it a bend, which will readily release it. If the can is too tight, you may have to enlarge the hole by sanding the edge on a spindle sander. Each can is now fastened to its top with four screws. Use about a $\frac{3}{4}$ " No. 10 round-head screw. Label each can for easy identification.—EDMUND HANLEY.



Note how splines of maple or other hard wood are used to strengthen the drawer tops. The back of the cabinet may be plywood or wall board



Holding Parcels in Bicycle Basket

NEWSPAPER boys and others who carry lunch boxes, books, and packages in a bicycle basket can save themselves much annoyance by making an adjustable rubber strap to hold in the articles. Cut a band about $\frac{1}{2}$ " wide from an old inner tube and connect two small harness snaps to it.

How to Improve a Soldering Tip

IF THE tip of soldering copper is hammered for about five minutes on an anvil, it seems to hold the heat better without "burning."—K. F. K.

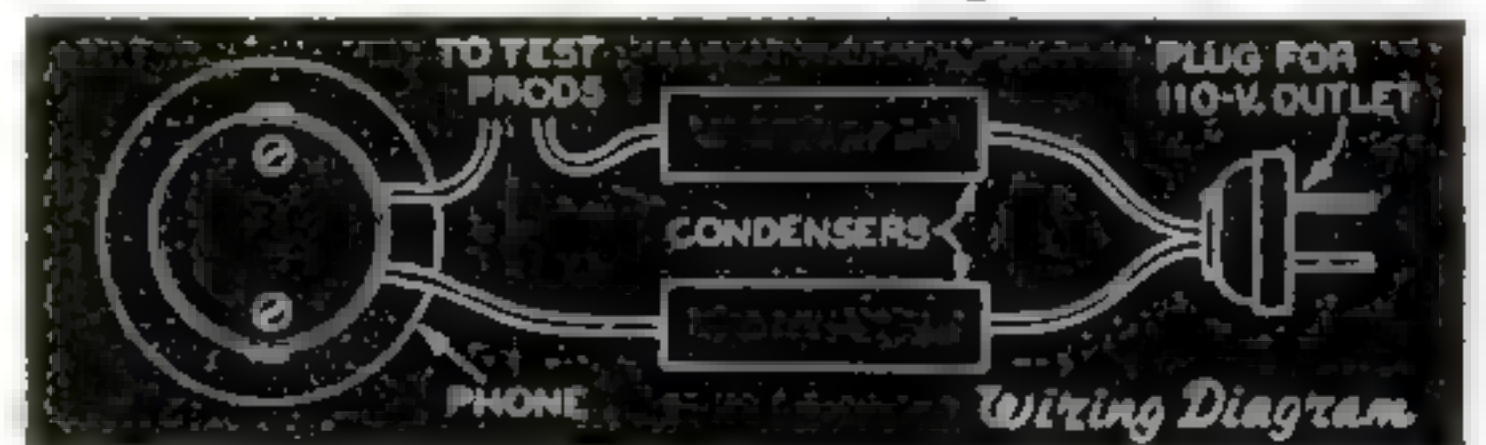
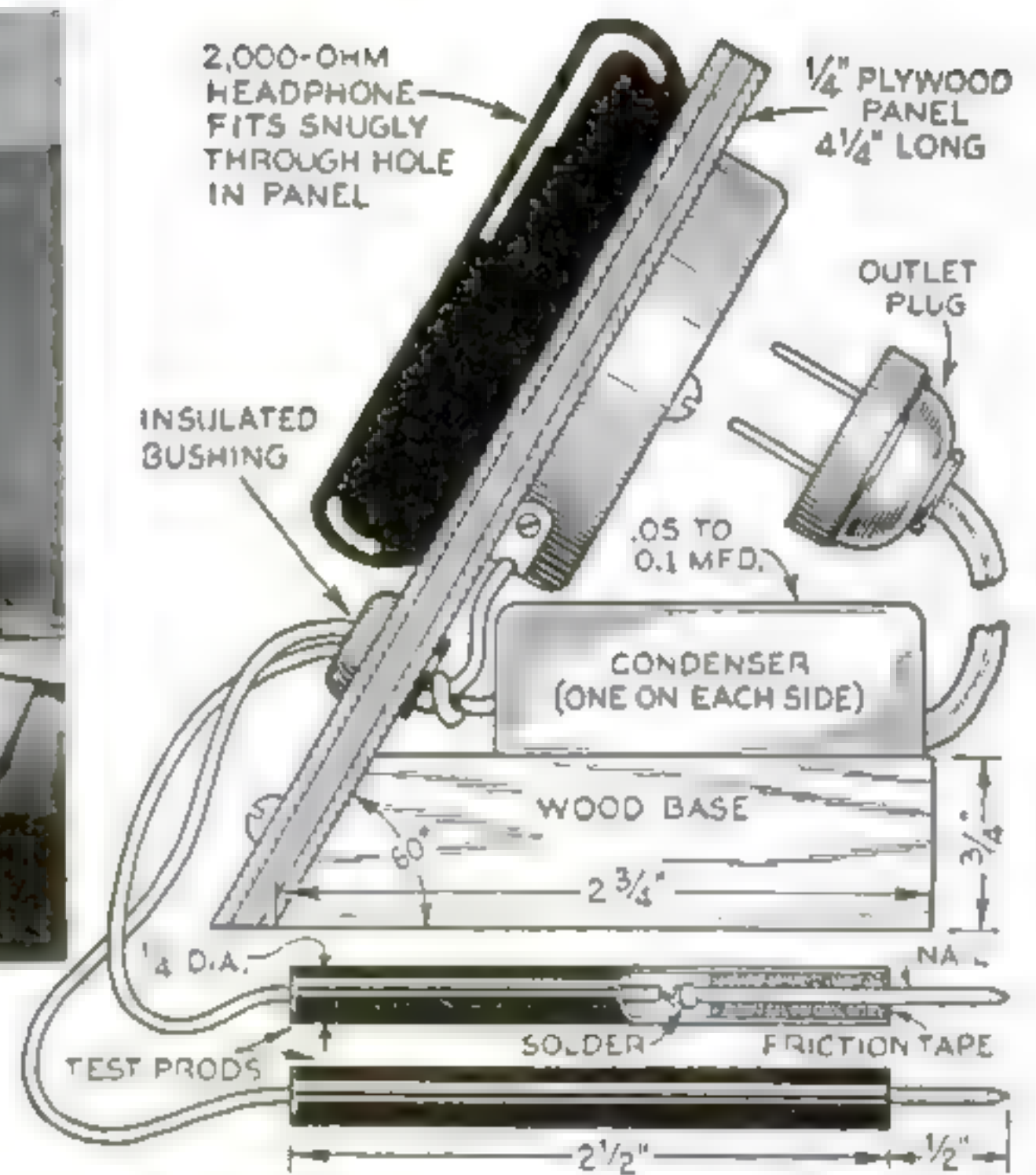
Old Phone Converted into a Tester



This all-purpose tester, operated by 110-volt house current, indicates a closed circuit by a click in the phone

BECAUSE of its extreme sensitivity and low current drain, this all-purpose tester can be used to check resistances of several thousand ohms as well as ordinary household appliances. It is operated by the house current, and a loud click in the phone indicates that the circuit under test is closed.

The required parts are a good headphone, two well-insulated paper condensers of .05 to .1 mfd. capacity, a few feet of lamp cord, and some wood. Fasten the panel to the base at a 60-deg. angle, attach the parts, and make the connections. The test leads are brought out through an insulating bushing in the



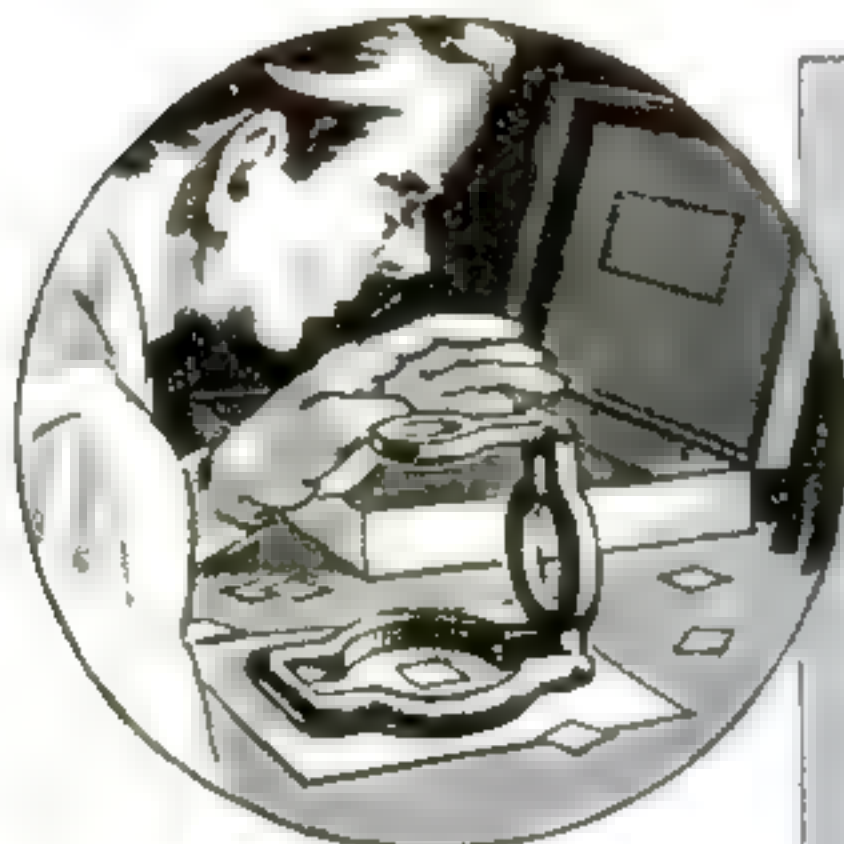
panel. Rubber lamp cord, which can be split, will serve very well for these leads. Test prods can be made from fiber tubing and nails, with friction tape to fill in between the nails and tubes. Solder and insulate all connections.—L. T. REITZ.

Adjustable Wooden Frame Holds Magnifying Glass

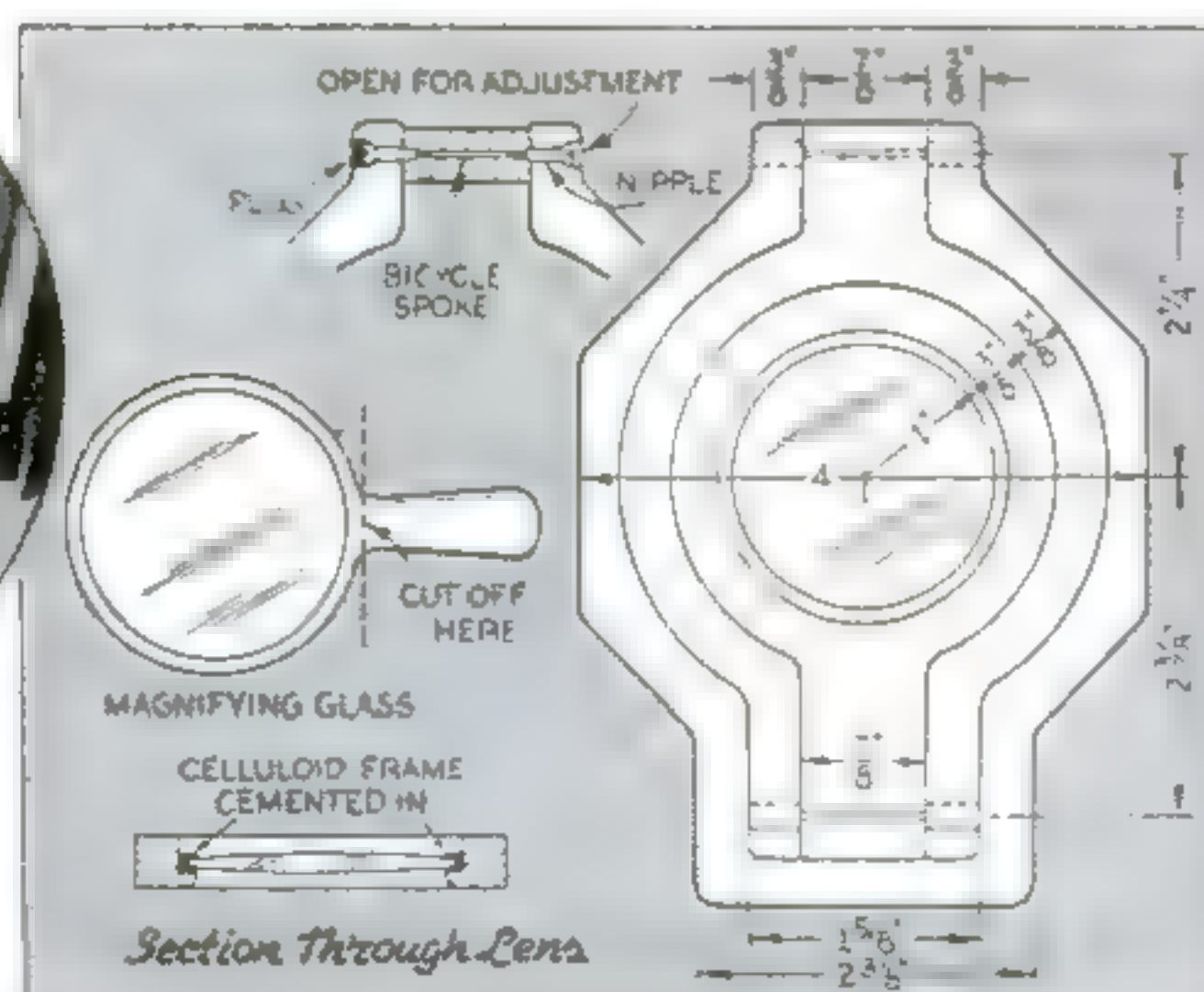
IN USING an ordinary magnifying or reading glass, especially if some delicate work has to be done with its aid, it is a considerable handicap to have only one hand free. For threading needles, examining a sliver in

the finger, inspecting cancellations on stamps, and many similar jobs, an adjustable folding frame to hold the lens will be found very useful. A neat-looking, compact holder may be made as shown from gum, mahogany, walnut, or maple jig-sawed and sanded to shape.

The proper tension on the joints to hold the glass in the required position is obtained by means of a short length of bicycle spoke and two nipples. The nipples are countersunk, and one is plugged over. The other is left exposed so it may be adjusted with a small screw driver. Small lenses suitable for this purpose are sold in ten-cent stores.—L. R. BROWNE.



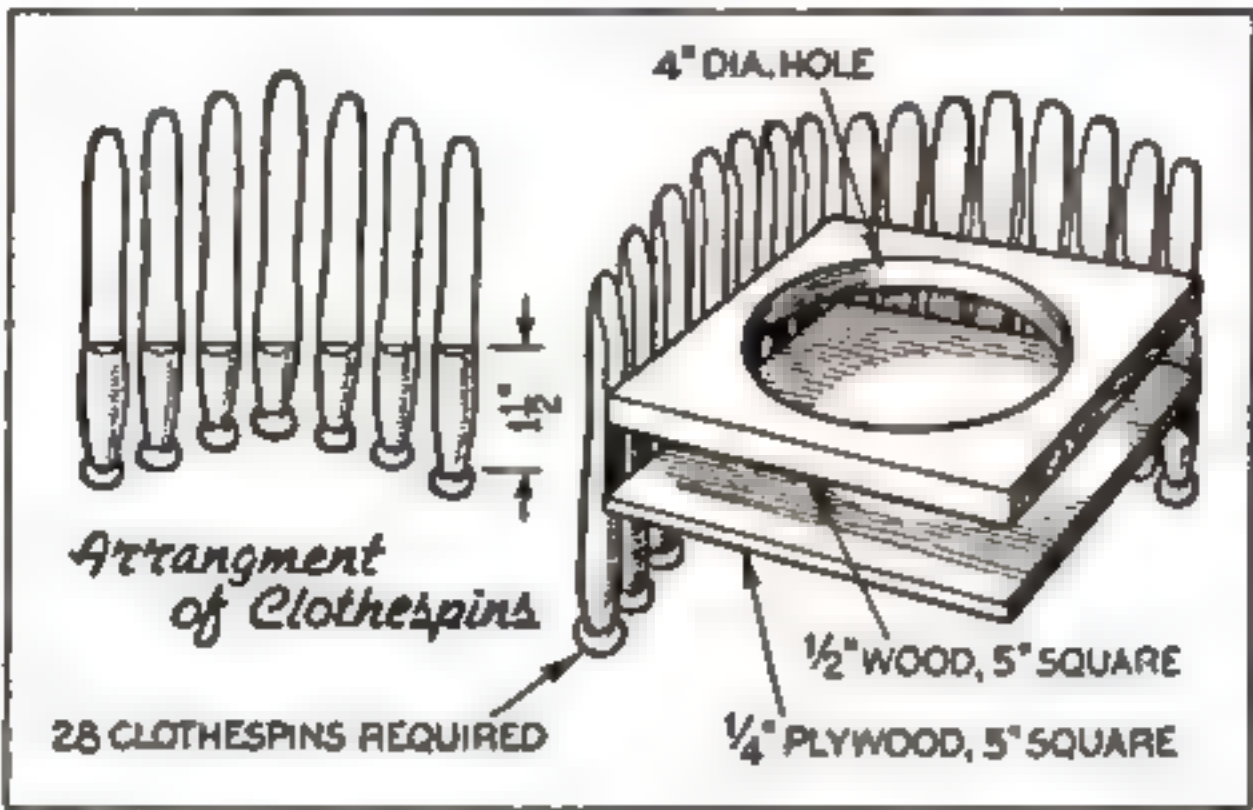
The frame, which is jig-sawed from any hard wood, folds flat as shown in the drawing at the right



Clothespins Decorate Plant Stand

SEVEN ordinary clothespins are used to decorate each side of this square holder for a small plant in a can or pot. The clothespins are cut at varying heights to give the arch effect. The lower plywood square rests on the cut ends of the clothespins. The upper square, which is $\frac{1}{2}$ " thick wood, is fastened 1" above the lower one with glue and eight brads driven through the legs next to the corners. A strip of cloth is wound around the holder to bind the joints while the glue is drying. If a flowerpot with slanting sides is used, a smaller circle should be cut to fit from the plywood square before assembling the parts.

—HAZEL SHOWALTER.



A soft shade of rust, tan, brown, or green is used for painting the holder

Scissor Handles Padded with Strips of Rubber



Wrapping vulcanizing tire patch around the handles of scissors to prevent finger fatigue and soreness

SOMETIMES it is necessary to cut with scissors for a long time, or to cut through heavy material. To avoid discomfort, have on hand a pair of scissors treated as shown. Vulcanizing tire patch, obtainable at most tire service stations, is cut into $\frac{5}{8}$ " strips, wound around the handles, and stretched and overlapped about halfway at each turn. The ends are held in place with string or a spring clothespin while the rubber is vulcanized in an ordinary oven at very low temperature.

WIRE GAUGES

[METAL WORKING]

Gauge No.	Steel	Copper and other metals
0000000	0.4900	0.5800
000000	0.4615	0.5165
00000	0.4305	0.4600
0000	0.3938	0.4096
000	0.3625	0.3848
00	0.3310	0.3249
0	0.3065	0.2893
1	0.2830	0.2576
2	0.2625	0.2294
3	0.2437	0.2043
4	0.2253	0.1819
5	0.2070	0.1620
6	0.1920	0.1443
7	0.1770	0.1285
8	0.1620	0.1144
9	0.1483	0.1019
10	0.1350	0.0907
11	0.1205	0.0808
12	0.1055	0.0720
13	0.0915	0.0641
14	0.0800	0.0571
15	0.0720	0.0508
16	0.0625	0.0453
17	0.0540	0.0403
18	0.0475	0.0359
19	0.0410	0.0320
20	0.0348	0.0285
21	0.0317	0.0253
22	0.0286	0.0226
23	0.0258	0.0201
24	0.0230	0.0179
25	0.0204	0.0159
26	0.0181	0.0142
27	0.0162	0.0126
28	0.0150	0.0113
29	0.0140	0.0100
30	0.0132	0.0089
31	0.0128	0.0080
32	0.0118	0.0071
33	0.0104	0.0063
34	0.0095	0.0056
35	0.0090	0.0050
36	0.0085	0.0045
37	0.0080	0.0040
38	0.0075	0.0035
39	0.0070	0.0031
40	0.0066	0.0028
41	0.0062	0.0025
42	0.0060	0.0022
43	0.0058	0.0020
44	0.0055	0.00176
45	0.0052	0.00157
46	0.0050	0.00140
47	0.0048	0.00124
48	0.0046	0.00099
49	0.0044	0.00088
50		

Note: The "Steel Wire Gauge" is the same as Washburn and Moen, American Steel and Wire Co., and Roebling gauges. The gauge for copper is the same as the American Wire and Brown & Sharpe gauges. Dimensions given in the table above are in decimals of an inch.

POPULAR SCIENCE MONTHLY SHOP DATA FILE

Electric Drier



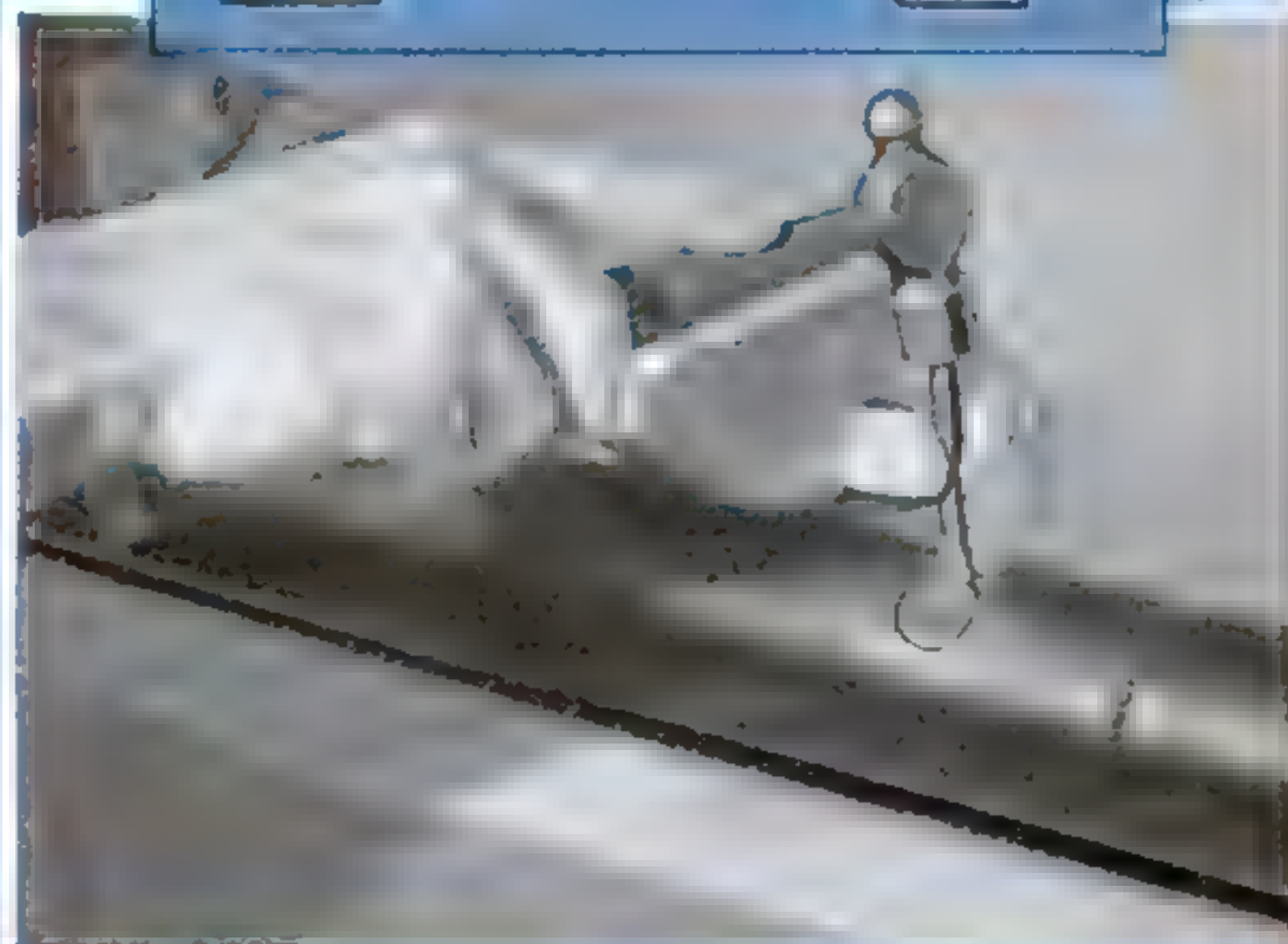
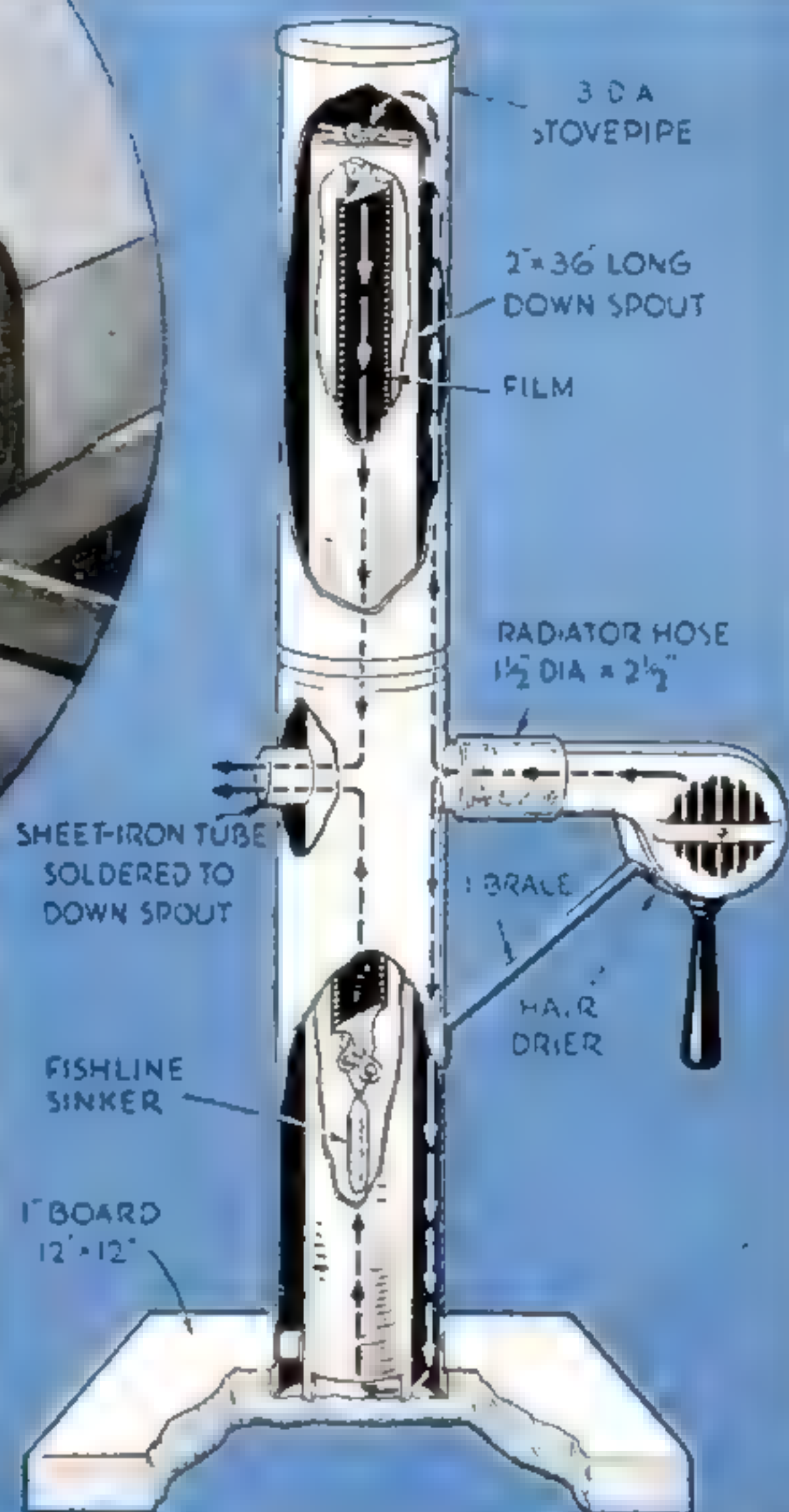
QUICK, even drying of 35-mm. film helps in large measure to retain fine grain, but the average owner of a miniature-camera hesitates to purchase a heated, blower-type drier. The one illustrated, which will do the work of an expensive commercial drier, was built for \$3.54. The heart of the device is an electric hair drier, obtainable at almost any drug store.

The parts required: 1 electric hair drier; 2 lengths of 3" stovepipe; 1 piece of 2" down spout, 36" long; 4 small paper clips; 2 fishline sinkers, 1 oz.; 2 kitchen scouring pads; 1 wood block for base; acid core solder, and black enamel.

The hair drier is not altered, but two metallic kitchen scouring pads are placed over the air intakes. These pads are first dipped in mineral oil and then hung in a warm place until they cease to drip.

The base is a 12" square piece of 1" thick board in the center of which a 3" hole $\frac{1}{2}$ " deep is bored. The two pieces of stovepipe are joined, and enough is cut from each end to make a tube 38" long. Two holes are cut in the center, opposite each other. One is 1" in diameter, the other, $1\frac{1}{2}$ ". A strip of sheet metal 1" wide is rolled into a circle and soldered into the $1\frac{1}{2}$ " hole. Also, an an-

By
**W. C.
CHENEY**



The necessary holes are cut in the stovepipe and down spout with a chisel after they have been slipped on a rod or piece of iron water pipe. Above is a diagram showing how the heated air circulates through the tubes

for Miniature Films

gle brace of 1" strip is soldered to the pipe and bent up to support the outer end of the hair drier. A piece of 1½" radiator hose, 2½" long, is slipped over the 1½" opening, and into the other end of this hose is placed the nozzle of the hair drier.

One end of the down-spout tube is notched for ¾" as shown, and on each end are soldered three angles of sheet iron, which center the tube in the pipe. On the tube, opposite the 1" hole in the pipe, is cut a 1" hole and into this is soldered a sheet iron tube ¾" long.

The pipe is now set in the hole in the wood base. The tube is slipped into the pipe, and the 1" sheet-iron nipple is slipped into the 1" hole in the pipe and soldered. The hair drier is set in place, and a baking-powder can lid is obtained to cover the upper end of the pipe. The unit is then given a coat of black enamel.

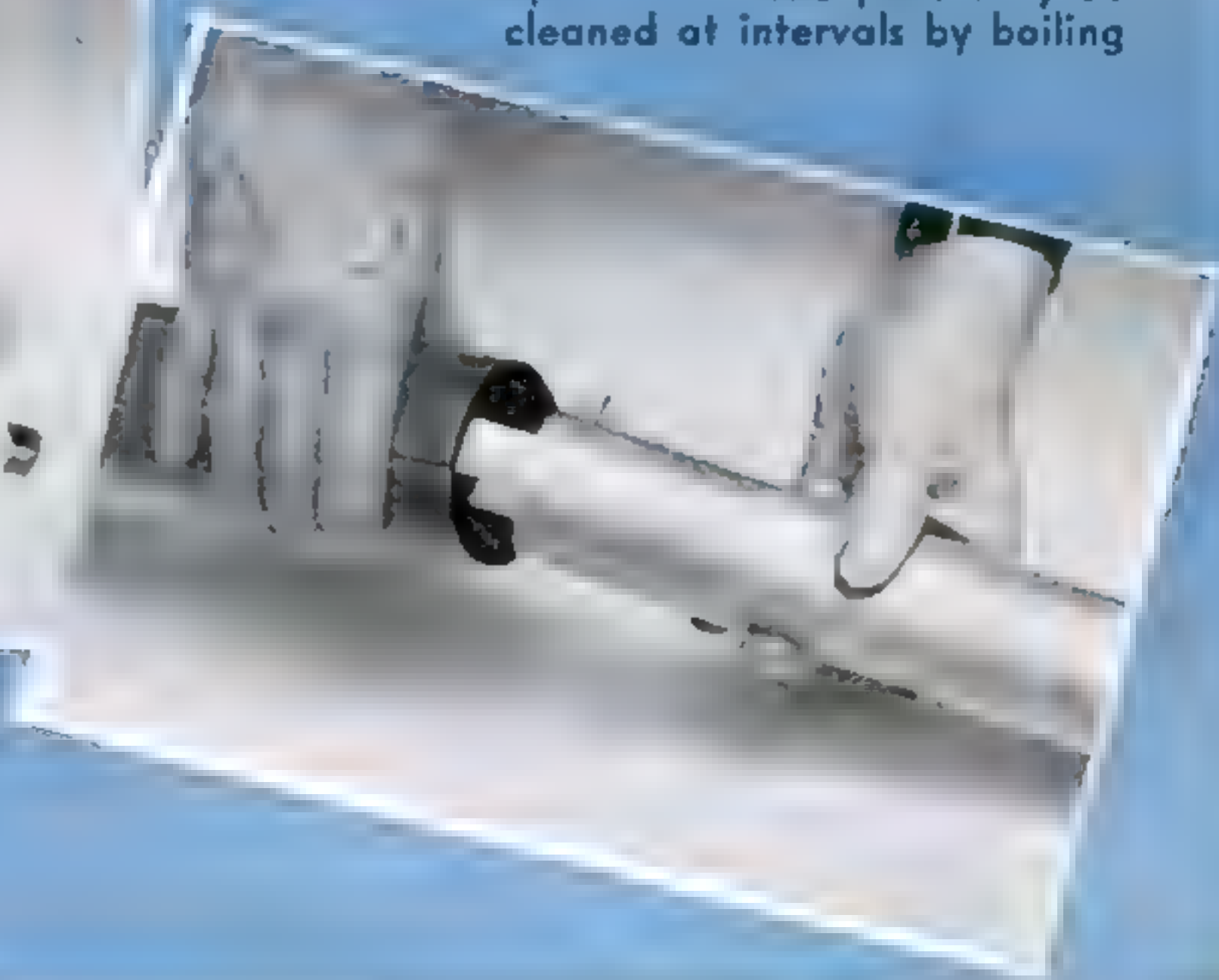
If the film is the eighteen-exposure type, it may be used "as is." However, if it is thirty-six exposure, it must be cut in two equal pieces. Attach the sinkers to two of the clips, which are then fastened to the ends of the films. The other two clips are next attached. Short pieces of wire are slipped through the eyes of these clips. The films are now low-

ered into the tube, the can lid is placed on the pipe, and the hair drier is started. In from six to eight minutes the film is bone dry and perfectly clean.

The oiled metallic pads pick up every particle of dust at the air intakes and must be cleaned occasionally by boiling, or new pads may be attached.



How the lower end of the inner tube is notched and three small sheet-metal angles are soldered on. This end of the tube is then slipped down into the outer casing as illustrated at the right



Two metallic kitchen scouring pads, coated with a film of mineral oil, are placed over the intake openings as shown above to pick up all dust. The pads may be cleaned at intervals by boiling



The developer is poured into the balloon through a rubber tube. The bottle is then laid on its side on a shelf so the solution can be easily drawn as shown at right

Developers Kept from Air in Toy Rubber Balloons

TO PROTECT my photographic developers from spoiling through oxidation, I devised a system of storing them in toy rubber balloons. The balloons prevent air from getting to the solutions, regardless of how much is poured out, because they contract to suit the liquid remaining in the bottle.

A 7" length of rubber tube is fastened to the mouth of a large red or black balloon with rubber cement, and the balloon is lowered into a suitable bottle. Place a funnel in the protruding tube and pour the solution through it into the balloon. As the balloon fills, stretch the tube and the mouth of the balloon upward to create

a vacuum for drawing in the solution. The bottle merely provides a stable wall for the balloon.

When the bottle is full, the tube can either be bent double and held with a rubber band, or a hard rubber stopcock (obtainable at a drug-gist's) can be attached to its end. The bottle may be kept on its side on a shelf over the darkroom worktable with the tube hanging down within easy reach of your work.

—LOUIS HOCHMAN.



ACID SHORT-STOP BATH

[PHOTOGRAPHY]

The following short-stop bath solution is used after development and before the print is immersed in the hypo solution. Its duty is to arrest development. This obviates the need of rinsing and lessens the danger of stained prints. Some photographers use this bath also for negatives after they have been developed.

Water	32 oz. or 1 liter
-------	-------------------

Acetic acid (28% concentration)	1½ oz. or 48 cc.
---------------------------------	------------------

A 28% concentration of acetic acid may be obtained by adding three parts of glacial acetic acid to eight parts of water.

Provided the developer is drained for two or three seconds, approximately twenty-five 8" by 10" prints or their equivalent may be processed in the bath before it becomes alkaline and must be discarded.

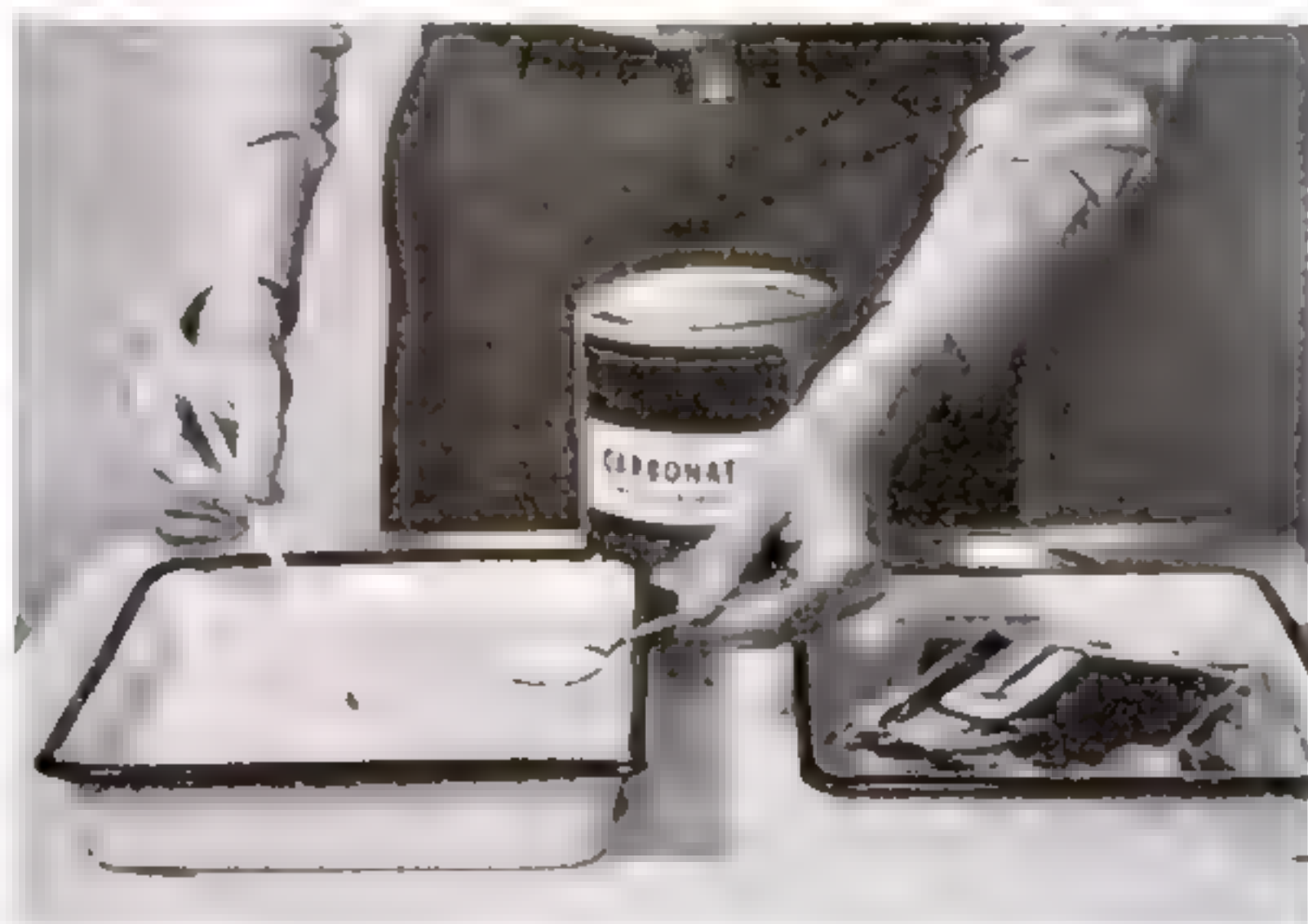
POPULAR SCIENCE MONTHLY SHOP DATA FILE

Reel on Photoflood Stand Holds Long Lamp Cords

THE long cords customarily used with photoflood light stands become somewhat of an annoyance if the lamps are set up close to an outlet and also when the lamps are not in use. They are constantly getting underfoot or becoming tangled. An easy way to keep them out of the way is to make a reel as shown. It is cut from pressed composition wood or plywood and fastened to the top of the stand so that the lamp cord can be coiled upon it as desired.—H. R. H.



A reel cut from thin material, as at the left, is fastened to the photo lamp stand



After being fixed, the prints are placed in sodium carbonate

Extra Bath Saves Time in Washing Prints

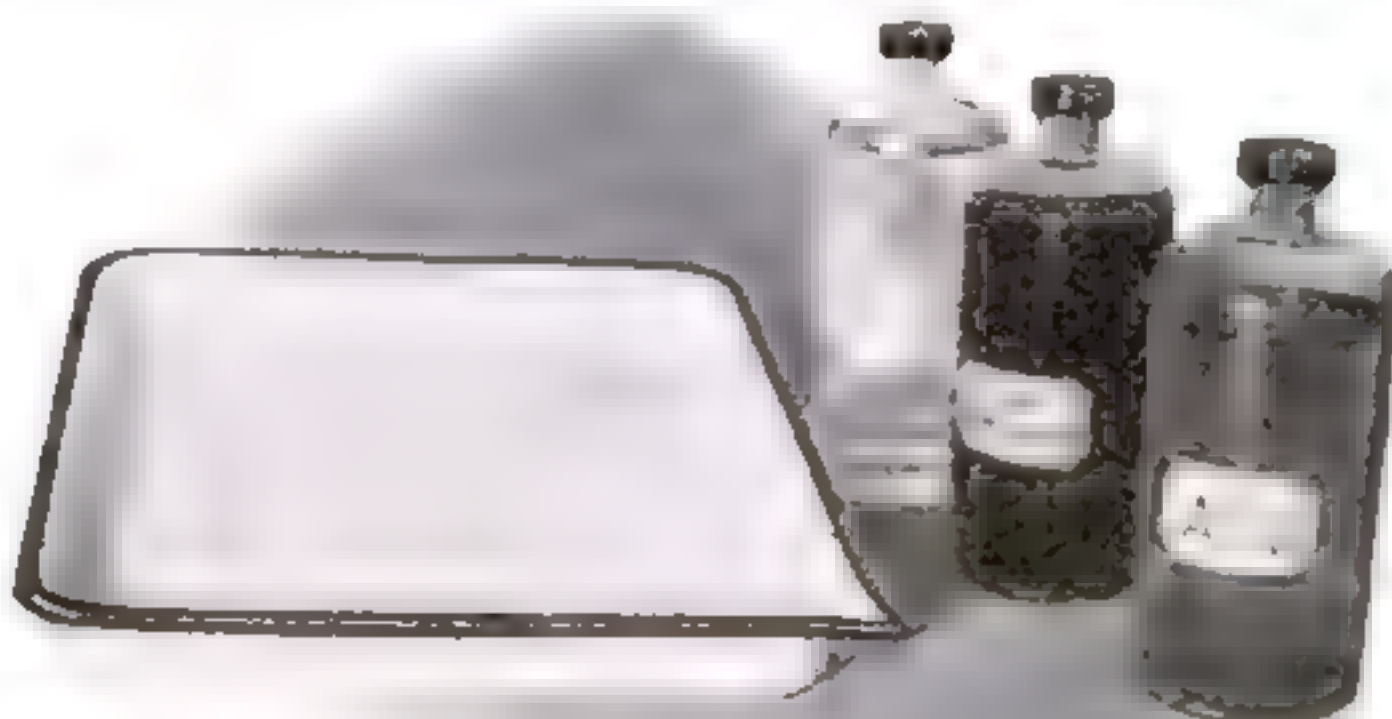
PHOTOGRAPHIC prints may be washed much more quickly if they are immersed for one minute in a dilute solution of sodium carbonate. This is done after they are fixed but before they are washed. A solution of proper strength may be made by dissolving $\frac{1}{3}$ oz. of the sodium carbonate in 1 qt. water. By neutralizing the acid of the fixer, it enables the remaining salts to be removed more easily. After this extra bath, a ten-minute wash in running water is said to be sufficient to remove the hypo.—K. M. S.

CLEANING PHOTO TRAYS

[PHOTOGRAPHY]

When trays become badly discolored, a thorough cleaning can be given them by the following method:

1. Half fill the tray with water.
2. Add several drops of acid (acetic, dilute sulphuric, or dilute hydrochloric) and agitate the solution.
3. Add several drops of potassium permanganate solution (saturated) and agitate well.
4. Empty the tray and add hypo solution (old, discarded hypo is satisfactory) to remove the stains.
5. Rinse well with water, and the tray will be as clean as when new.



POPULAR SCIENCE MONTHLY SHOP DATA FILE

Reflector Insures Soft Portrait Lighting



With a No. 2 photoflood, this light can be used alone for portraits

THE broad, soft light source so necessary for professional-looking photo portraits can be duplicated easily at home by the amateur with this reflector. Costing less than three dollars, the outfit does the work of expensive aluminum reflectors. It is 27" square and 8" deep. An aluminum deflector, which is available at most photo shops, is placed over the No. 2 photoflood bulb to diffuse the rays back into the reflector and protect the sitter's eyes from glare. The result is a diffused, comfortable light, yet at a distance of four feet a full exposure may be made at 1/10 second, F/4.5, on superspeed panchromatic film. A white cardboard reflector may be used opposite to lighten the shadow side of the face.

The reflector illustrated was made of 3/32" waterproof three-ply veneer, but other suitable materials may be used. Four sides are cut in the shape of a triangle with a base of 27" and an altitude of 16½". The pieces are nailed and glued into one unit by means of four strips of wood 1⅜" wide and ⅜" thick, beveled to fit into the corners. The construction is further strengthened by 1" wide strips



The reflector is mounted on a rod which can then be clamped in any standard light stand such as amateurs usually use

of tin fastened over the back of the seams with ⅜" roundhead screws. The inside is painted aluminum.

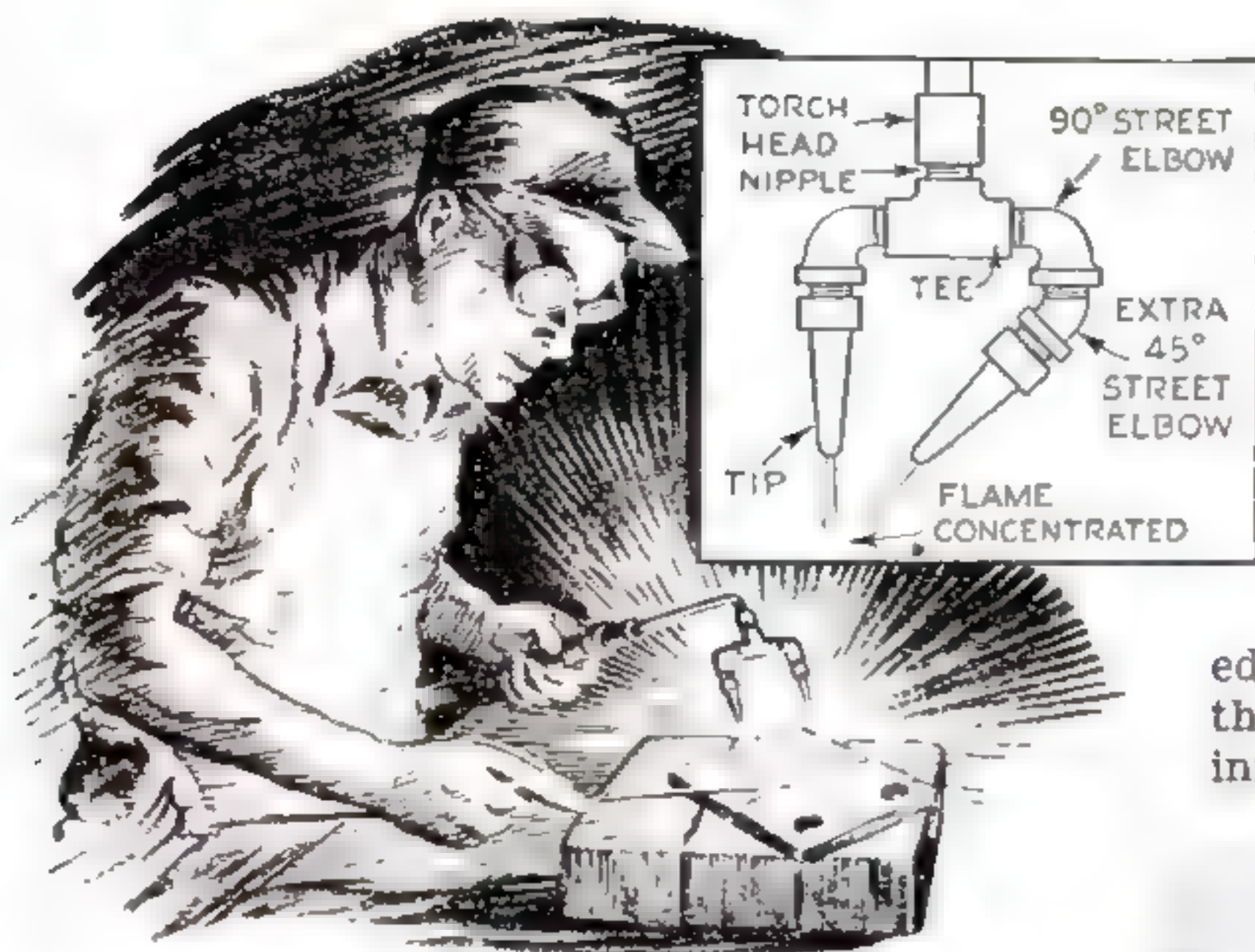
A hole must be cut into the apex of the reflector to permit the insertion of the light socket. An ordinary lamp-holding ring is fastened inside to hold the socket. An extension plug placed between the socket and the bulb brings the light into the focal point of the reflector.

Since the reflector is primarily for portraits, it is mounted at a downward angle. A ⅜" iron rod about 12" long is bent and bolted from the inside, as shown, through a reinforced section of the reflector. The latter will stand nicely balanced when placed on any of the standard light stands used by the amateur.—ALVIN J. BRAULT.

Giving Films a Hard Surface

MANY amateur photographers find it difficult to avoid scratching the dull side of their negatives. My method of avoiding this is to treat the films so that there is a hard, glossy surface on both sides. I develop the films as usual, run them through the acetic acid bath, fix them with hypo, then harden them with a chrome-alum bath (one tablespoon of chrome alum in one quart of water) for fifteen minutes before washing.—E. K. H.

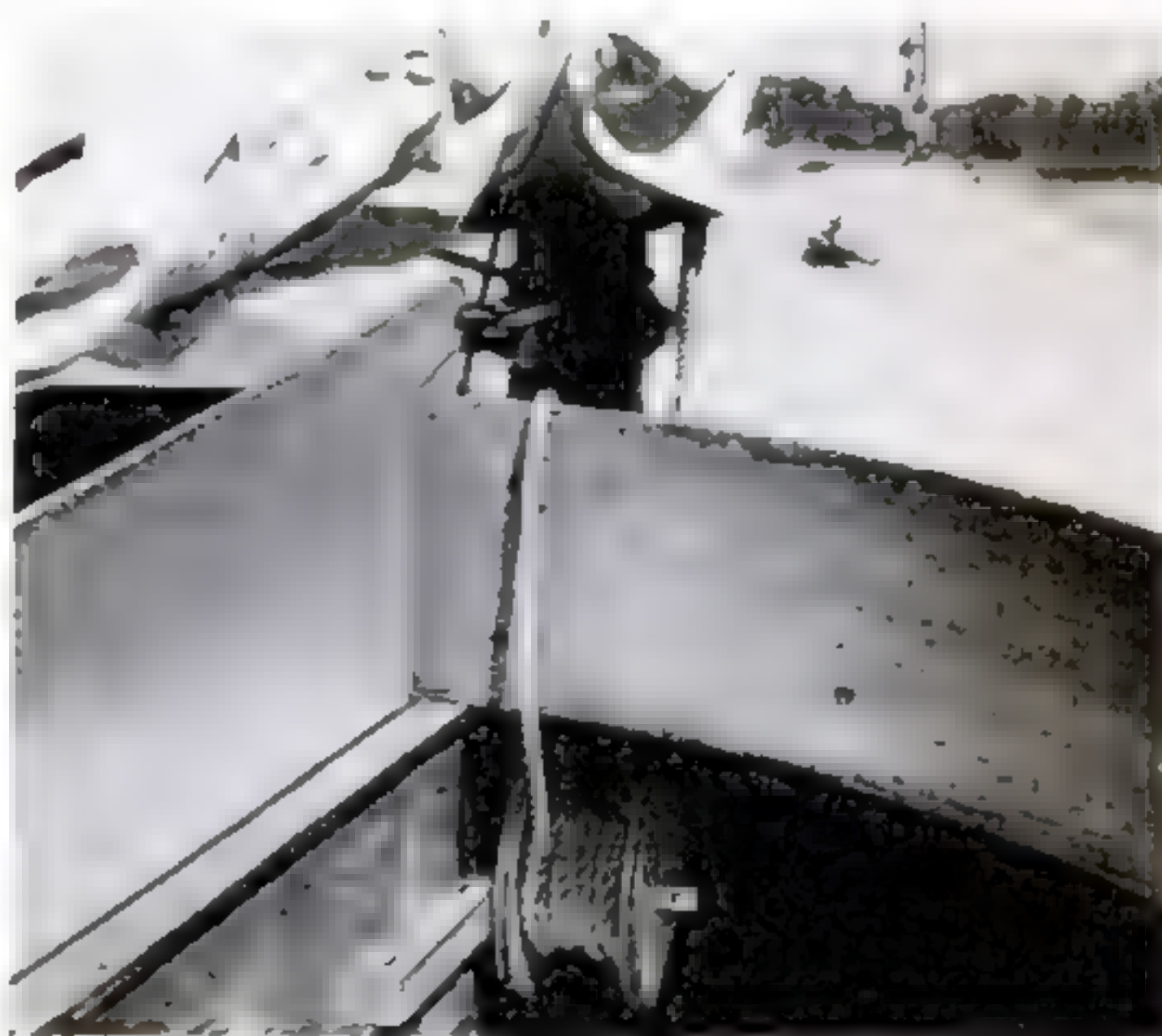
Acetylene Torch Equipped with Double Tips



The two tips spread the flame over a greater area

Sailboat Halyards Coiled Neatly on Hand Reels

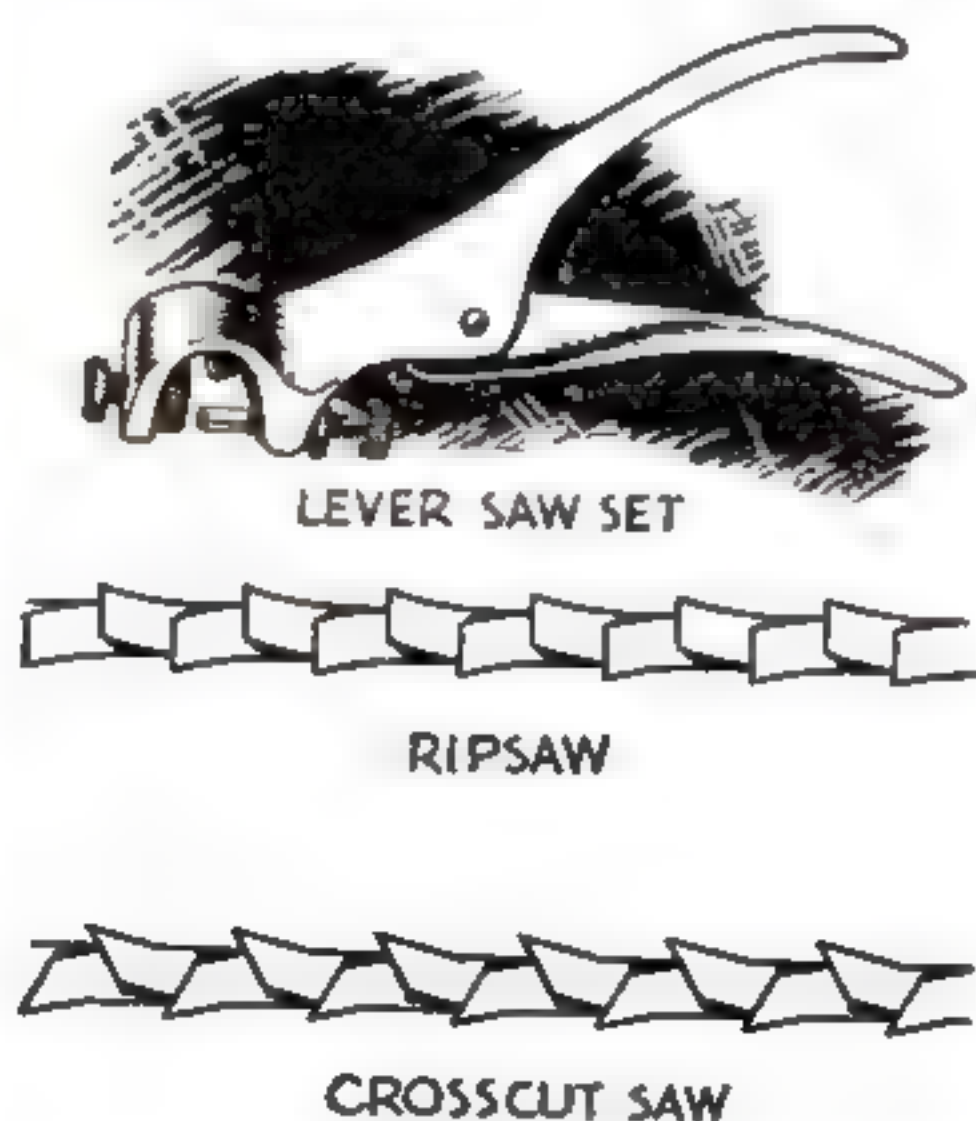
AMATEUR sailors are forever getting their halyards snagged or tangled, and it takes time and trouble to keep them neatly coiled. All this can be prevented by attaching two reels to the centerboard trunk, one for the mainsail and the other for the jib halyard. Each reel is mounted on a wooden dowel set into a cleat screwed to the centerboard trunk. It can be kept in place by means of a washer and a brass screw or pin driven through the dowel near the end.—H. B. HENRICKSON.



View of halyard reel mounted on centerboard trunk

HANDSAWS—SETTING

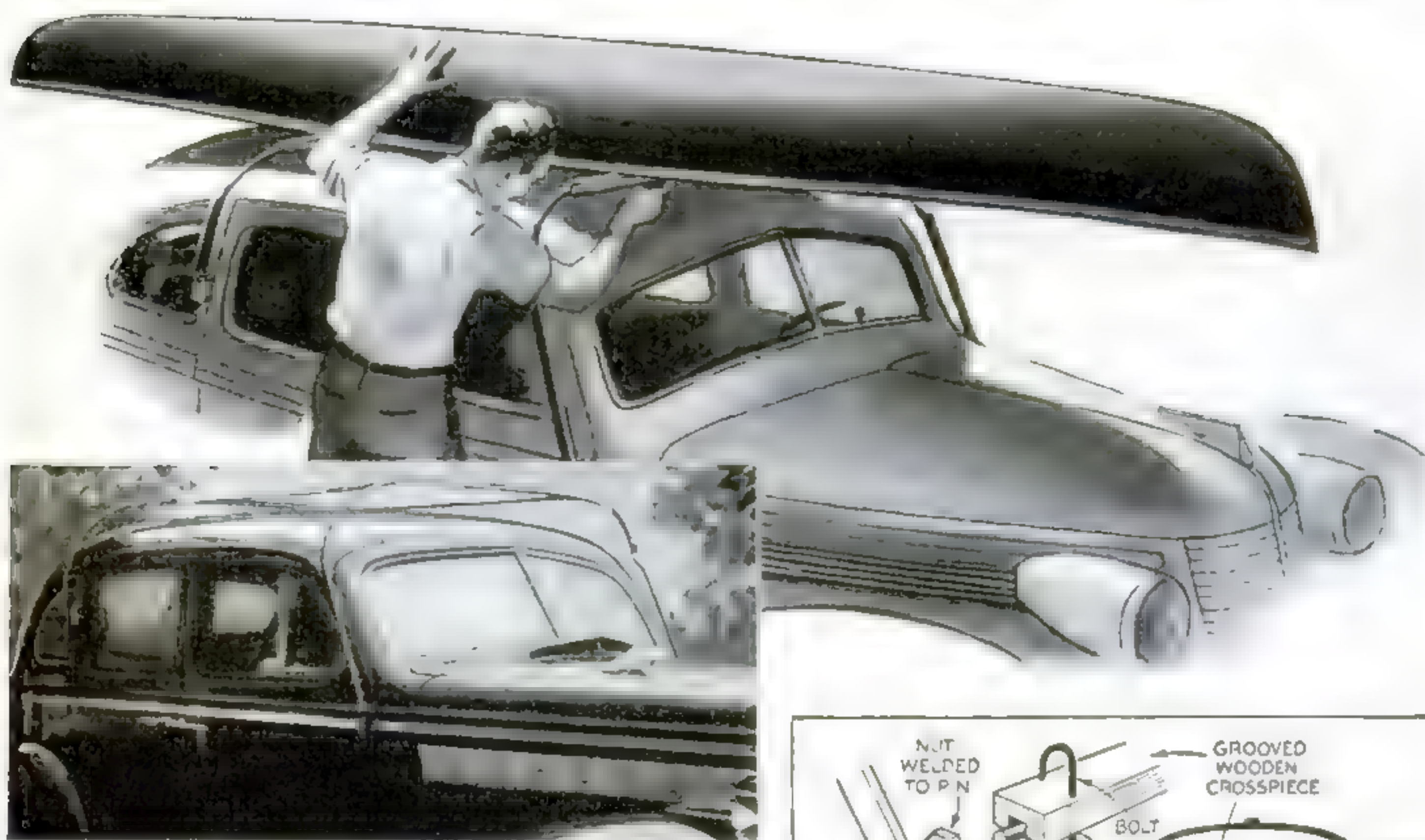
[WOODWORKING]



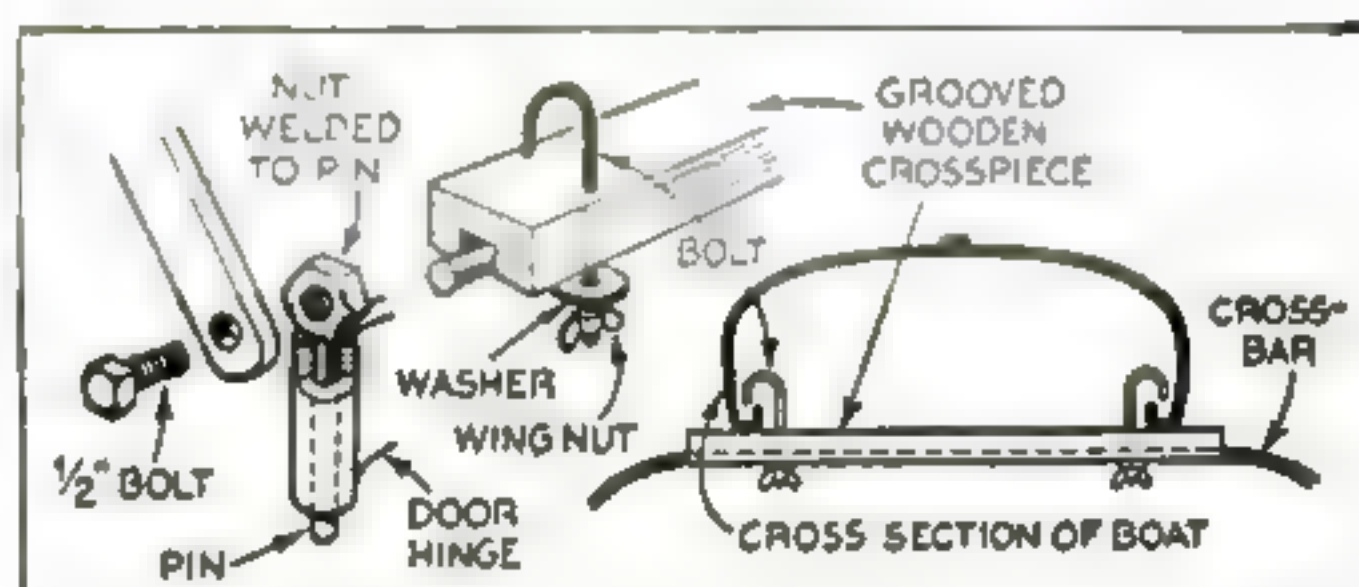
By the term "setting" is understood the bending of every other tooth to the right and the alternate teeth to the left. Both rip and crosscut saws must be set in order to cut a kerf wide enough to give clearance to the blade. The amount of set depends upon the number of points per inch and can best be learned by studying a new saw. Do not give more set to the teeth than necessary to insure easy cutting. Setting need not be done every time a saw is filed, but it must always be done after reshaping the teeth. Clamp the saw in a saw vise and, using any standard adjustable type of lever or plunger saw set, bend every tooth that points away. Bend only the upper half of each tooth and bend it a uniform amount in the same direction. Reverse the saw in the vise and bend the remaining teeth away from you.

POPULAR SCIENCE MONTHLY SHOP DATA FILE

Framework Supports Canoe on Car Roof



The rigging is made of cold-rolled steel and can be removed in five minutes. At right are the drawings



HERE is a rigging that may be used by canoe or kayak owners and others who need to carry light, bulky materials on their cars. It is quickly attached, does not mar the finish of the car, and does not look unsightly.

Pins in the upper hinges of the four doors are knocked out from the bottom, and cold-rolled steel is cut to replace them. The new pins are fitted into holes drilled in the faces of $\frac{1}{2}$ " hexagon nuts and welded in place. The nuts are on top of the hinges when the pins are inserted. Bars of $\frac{3}{4}$ " by $\frac{1}{4}$ " cold-rolled steel run from these nuts almost to the top of the car and are fastened to the nuts with $\frac{1}{2}$ " bolts.

Next, two pieces of $\frac{3}{8}$ " round cold-rolled steel are bent to conform to the top of the car with a few inches leeway all around. These are welded to the flat uprights. Finally, two round bars are welded from the front to the rear crosspieces. It is possible to cut, bend, and lap these pieces for a couple of inches, then tape them securely and carry them to the local welder to be welded.

In attaching a canoe or a kayak to this rigging, two pieces of wood 1" by $1\frac{1}{2}$ " may be grooved the whole length with $\frac{1}{2}$ " by $\frac{5}{16}$ " grooves to fit over the round bars that cross the top of the car. The boat rests on these pieces. Just inside where the coaming comes, bore four holes through the wooden pieces between the groove and the side, and put in long bolts, bent like a fishhook to catch the inside

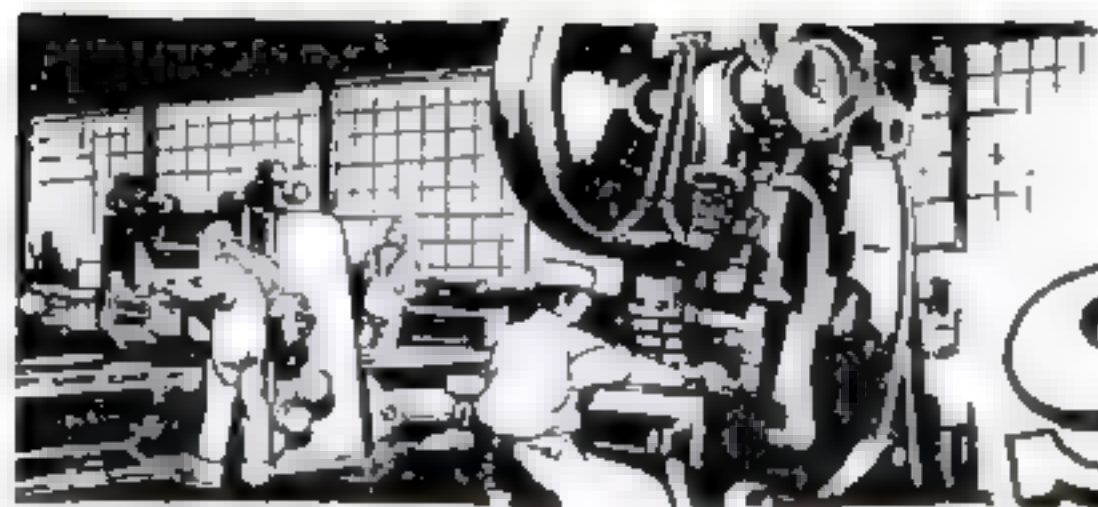
of the coaming. Tightening the bolts with wing nuts will then hold the canoe securely. Place just above each wing nut an oblong washer or a large round washer to prevent the crosspieces from shifting along the round bars. Felt glued on top of the wood will prevent damage to the boat.

If the front uprights follow the contour of the slanting windshield, a slight sway may be experienced, but small wooden blocks faced with felt and wedged halfway between the uprights and the car gutter will stop this.—G. WESLEY FLORANCE.

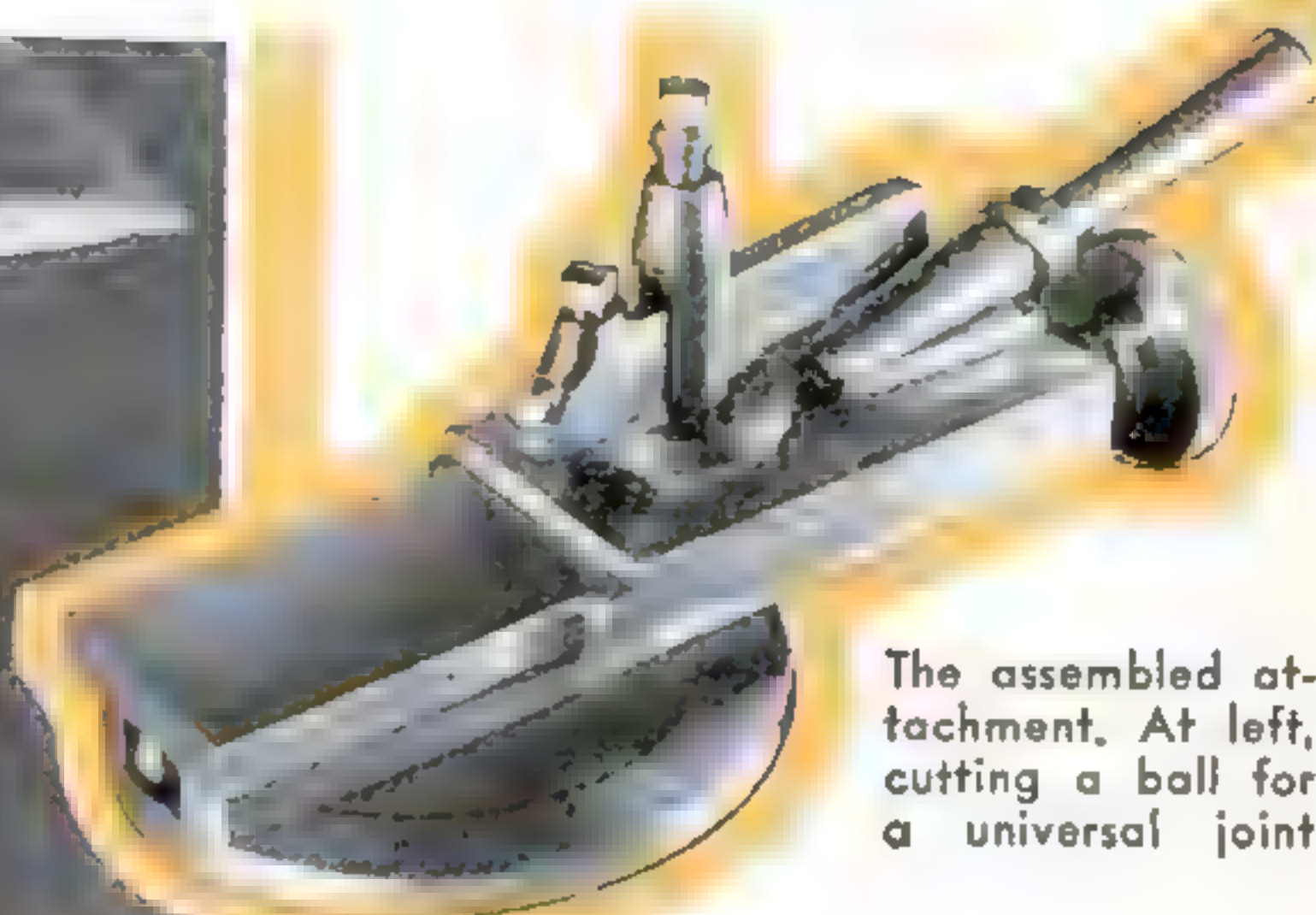
Spoons Measure Glue Powder

IN USING small quantities of casein glue in powder form, it is sometimes wasted because it is hard to judge the amount of water to be added. To solve this, I use a set of kitchen measuring spoons and a small dish made by cutting down an empty can. The brushes are made from bristles taken from an old floor brush and held in a strip of sheet metal.—ROY HANNING.





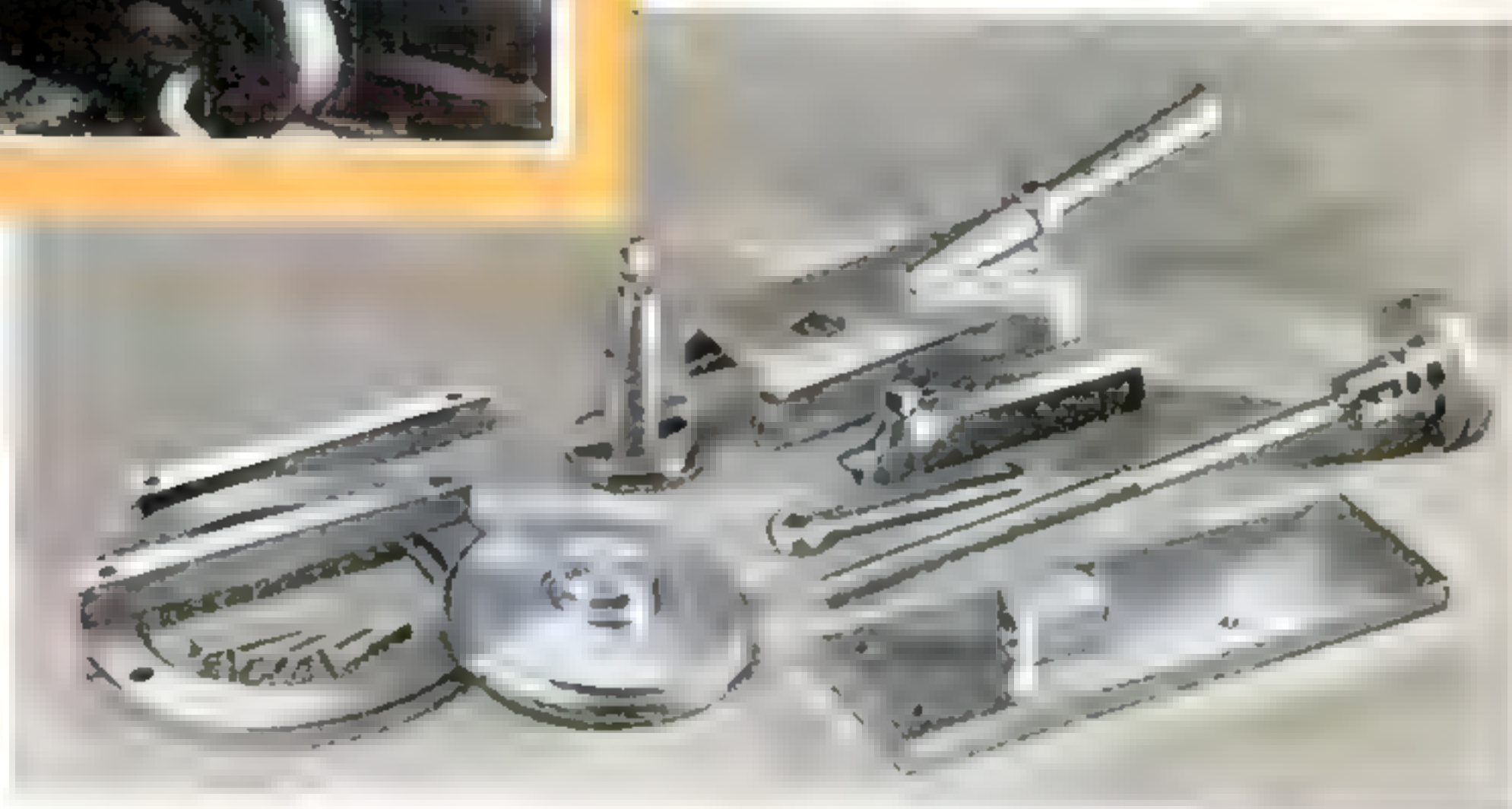
new SHOP IDEAS



The assembled attachment. At left, cutting a ball for a universal joint

Ball-Turning Attachment FOR A LATHE

By
**CHESTER W.
WOODSON**



The parts of the ball-turning device. It is comparatively simple to construct because it is made largely from cold-rolled rods and bars

SPHERICAL work such as ball cranks, hand levers, and ball-and-socket joints may be turned accurately with the attachment illustrated. This valuable lathe accessory is not difficult to build as it is made largely from cold-rolled steel rods and bars.

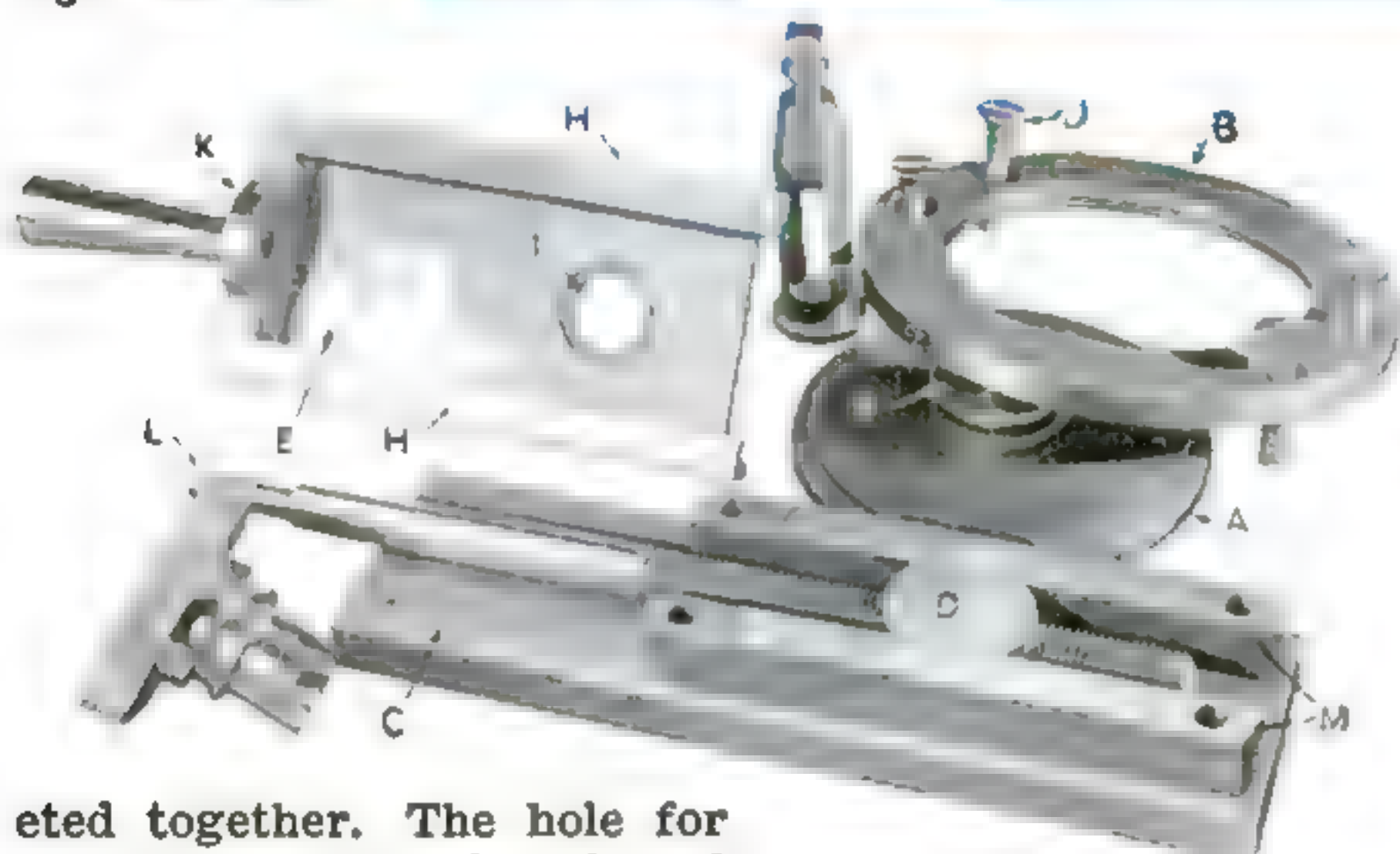
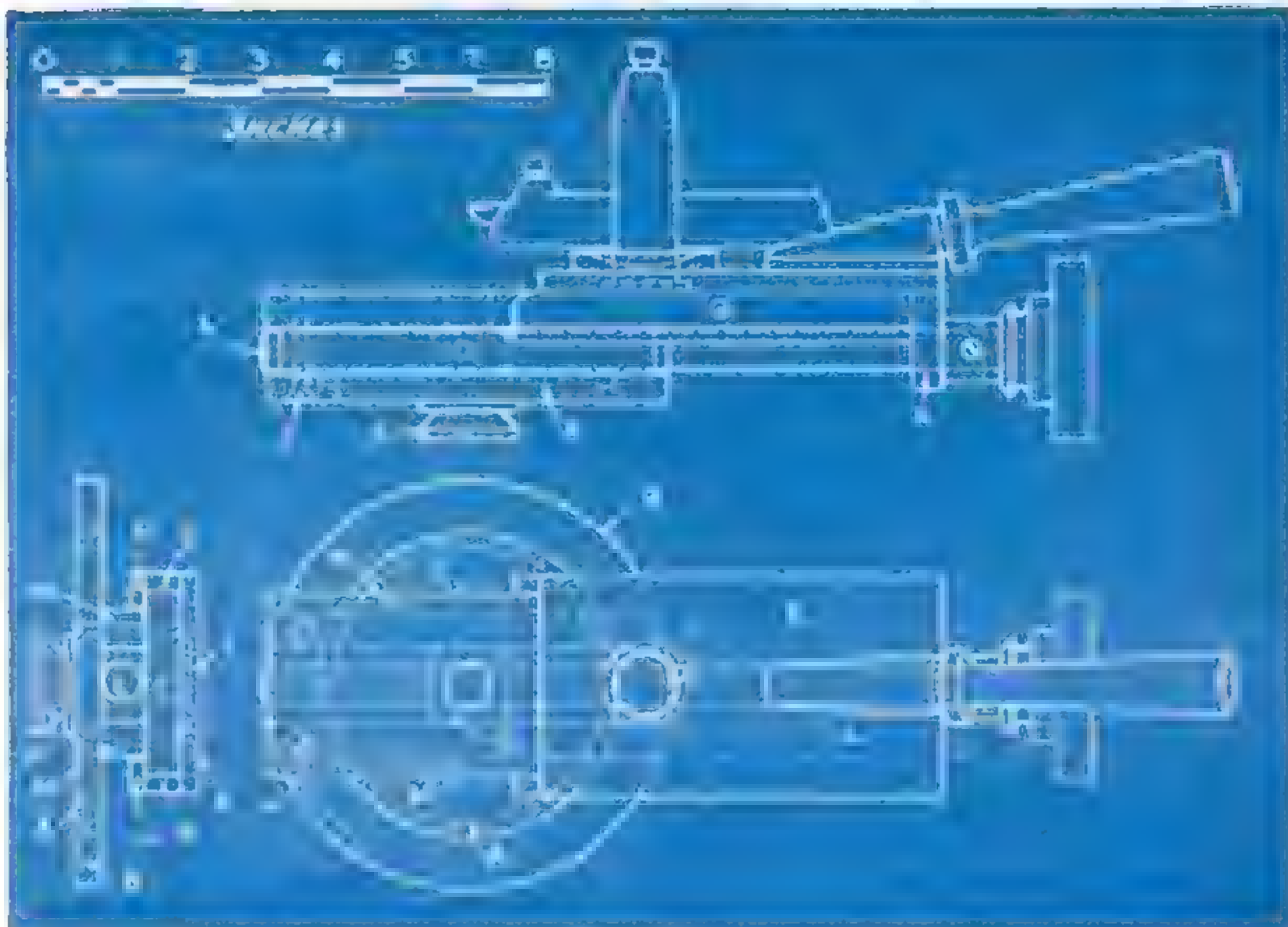
First, a disk marked *A* in the drawings should be made to mount on the cross slide in place of the compound rest on your lathe. Next, the ring *B* is made and recessed to fit *A* firmly, yet so it can be revolved. On this ring the remainder of the attachment is

mounted. Four holes are drilled in the ring to mount the bars *M* and the slide-rest base *C*. The nut *D* is turned out on the lathe, drilled and threaded $\frac{1}{2}$ "—13 for the cross-slide screw, and riveted in place in *C*.

The cross slide and tool post holder are next built up of cold-rolled steel flats and fitted to the base *C*. These parts are all riv-

Three views of the assembled attachment. As indicated by the inch scale, these are one fourth full size

The shapes and relation of the parts are made clearer in the photo below. The parts have been lettered to correspond with the drawings and text



eted together. The hole for the tool post is bored and recessed in the lathe. The lathe tool post can be used, or a duplicate can be made. The handle for controlling the tool when in use is turned from a 1" steel rod, and its base is

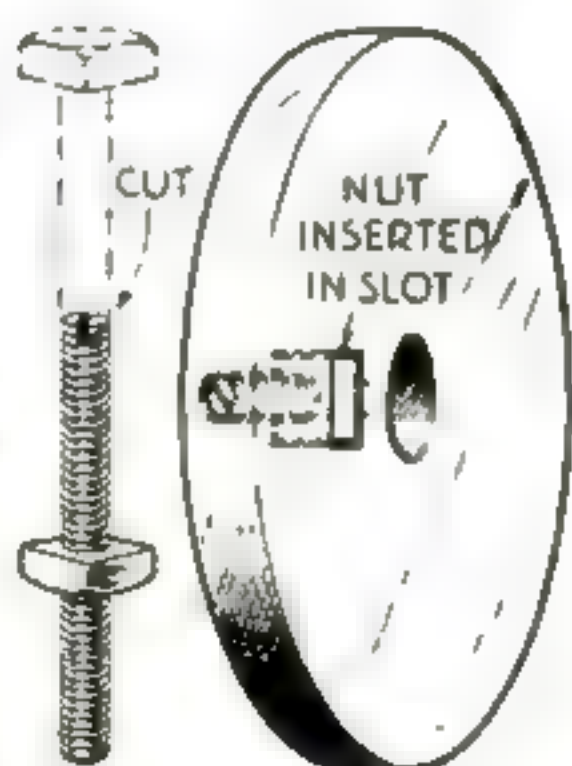
beveled and fastened to the cross slide with flathead screws. The handwheel is also turned out of steel and knurled. It is drilled to fit the cross-slide screw and held in place with a set screw.

When the parts are all assembled and working smoothly, the attachment can be tried out in the lathe. To turn a true ball, the axis on which the attachment swings must be set exactly under the center of the ball to be turned by adjusting the lathe carriage and the cross slide. When

you have it just right, lock the lathe carriage. The cross slide on the attachment is used only for adjusting the tool to turn balls of various sizes.

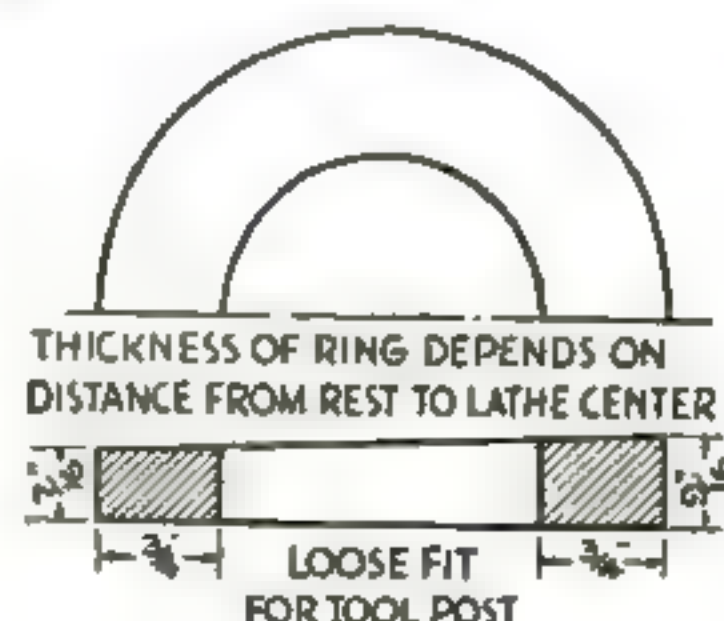
Set Screw to Hold a Wooden Pulley

A WOODEN pulley for any small machine may be fastened to a shaft with a set screw made from a bolt as shown. Cut off the head of the bolt and slot the end. Bore a hole just large enough to receive the bolt radially from the edge to the center of the pulley, and chisel a rectangular hole in the side of the pulley just large enough to receive the nut into which the bolt screws.—H. M. CHAPPELL.



Special Tool-Post Ring

TOOL-POST rings of the type illustrated have been used in student machine-shop classes with excellent results. This design is more rigid than that provided with most lathes and causes less trouble for inexperienced operators. The tool holder is adjusted to suit the work merely by turning the ring. The thickness may, of course, have to be changed.



THE EXPERT'S WAY OF USING Paint and Varnish Removers

By **RALPH
G. WARING**



blended with the solvents before being used.

Next, a number of newspapers should be folded and torn into quarter sheets for convenience. You will also need a flexible putty knife that has been carefully smoothed on an oilstone so that no nicks remain to scratch delicate woods or veneers; a clean paintbrush; several pads of No. 2 steel wool; a can of denatured alcohol; some 12" squares of burlap or bagging, and some clean rags free from snaps and buttons.

As far as practicable, take off all hinges, locks, knobs, and similar trim. Use a piece of old wall board or a similar surface covered with heavy paper upon which to do the

TO SCRAPE and sand off old, well-hardened paints and varnishes has always required considerable skill as well as long hours of finger-blistering toil. Paint chemists have devised various penetrating solvents, but many of these were found to evaporate too rapidly—often before they had had an opportunity to complete their work. Two men succeeded in overcoming this difficulty through the addition of paraffin wax to the remover formula, with the result that the wax floated on top of the coating of remover immediately after its application and thereby exerted a blanketing action to force the solvents down through the old coatings. Over this basic principle of remover formulation has waged one of the longest, bitterest, and most expensive patent suits in the history of the paint and varnish industry.

In actual practice, then, you can see the importance and economy of buying only a good quality of paint and varnish remover, and the equal importance of giving the can a thorough shaking, especially if the room is cold, to be sure that all the wax is completely



Removing softened finish with wide flexible putty knife. At top, using steel wool and denatured alcohol

work. This *must not be done* in the same room with a stove or other open flame or an explosion may result. Then follow the specifications given on the accompanying data sheet.

Contrary to the directions printed on many cans of varnish remover, *do not* use gasoline, benzine, or turpentine for the final clean-up. Why paint technologists and chemists have allowed this fundamental error to be printed on their can labels is something I cannot understand, for they all admit that where these materials follow the use of a remover containing wax, traces of the latter are spread over the *entire* surface treated, only to cause trouble later on in the finishing schedule. Do not be stingy with the alcohol, but wet the surface freely during the wiping operation.

After the work has dried overnight, the rest of the repairs and the sandpapering should be undertaken. All checks, open joints, blisters in veneers, and the like are, however, preferably repaired before stripping off the old finish with varnish remover because this material will seep into such defects and make it virtually impossible for the glue to hold permanently.

Occasionally some old paint films are especially thick and hard or are applied to surfaces on which a standard remover should not be used because of the danger of fire or explosion, or for other reasons. In that case recourse can be had to the old alkali types of stripping solution. I once had to take $\frac{1}{8}$ " of white lead paint from four good rush seats on antique Hitchcock chairs. A remover was out of the question since it would prevent finishing the rush later; the wax lodged in

the twisted strands of the rush would stop any finishing material from drying.

For this work I put on a pair of rubber gloves and then dissolved 1 lb. kitchen lye, used to make soap from grease drippings, in 1 gal. cooked laundry starch. This material was applied with a *fiber* scrub brush and left for about fifteen minutes, then loosened up with another brush. No animal hair brush could be used because the bristles would soon dissolve. Repeated applications and scrubblings finally took off the old, hard paint down to the well-preserved rush seating. A thorough scrubbing and washing with the hose removed any remaining lye, and all traces of it were effectively neutralized by giving the woven seats a complete soaking with strong vinegar. The seats were allowed to dry, then washed with the hose once more, and given a final drying in the sun. Although these seats are now in their third generation of use, it is quite evident that they will last at least one more generation.



Heavy-Duty Screw Driver

FROM piece of an old auto axle it is possible to make a heavy-duty screw driver like that shown above. The splined end forms the handle. After being annealed, the piece is turned in the lathe, the bit is forged on the other end, and the spline corners are slightly rounded with emery cloth. Heat to a bright red and plunge the tool into lubricating oil.

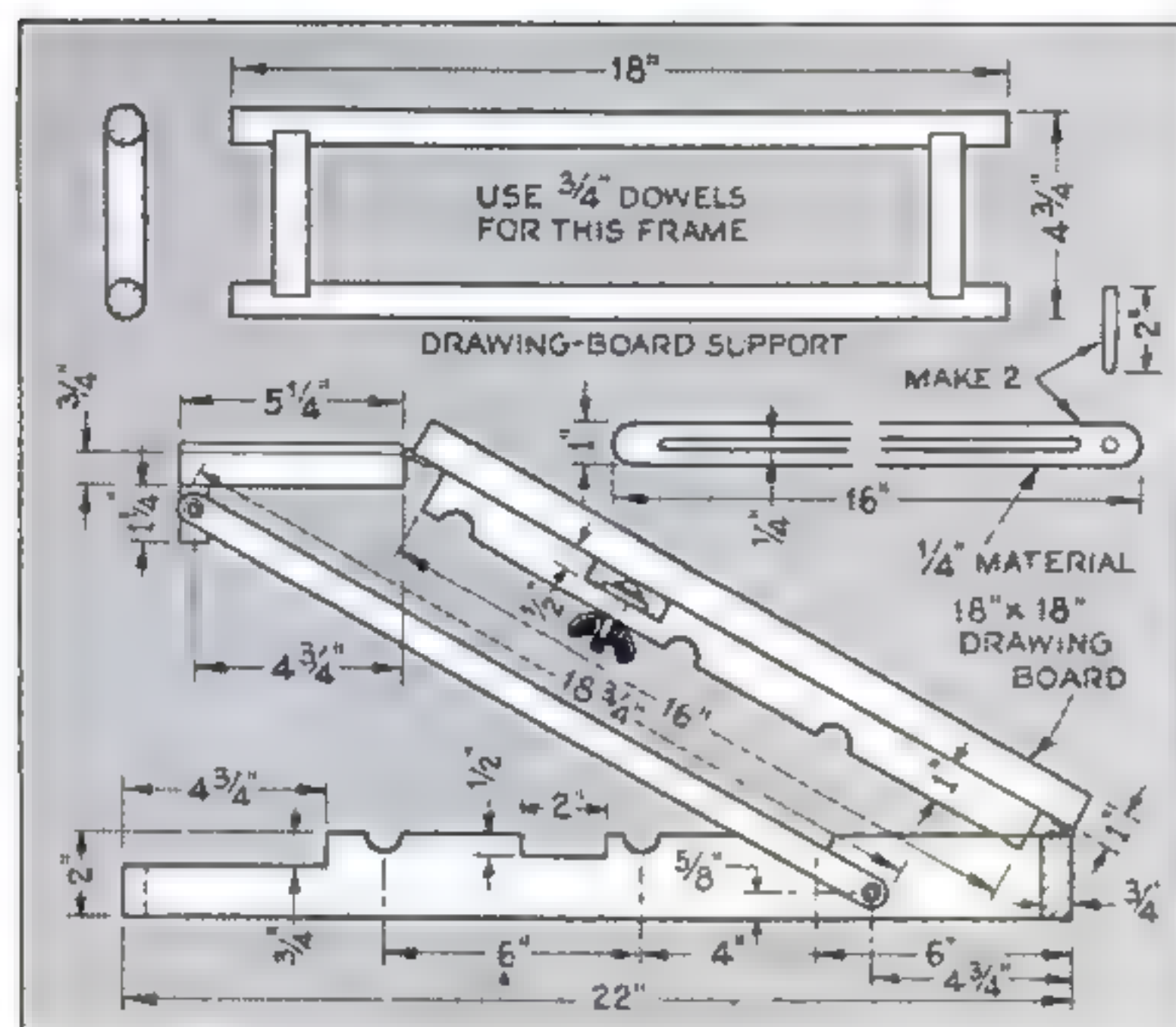
VARNISH REMOVER PRACTICE

[PAINTING]

1. Apply paint and varnish remover freely with one-way strokes only. Leave until the old surface softens, wrinkles, or blisters.
2. Peel off the material with a flexible putty knife. Wipe the knife on squares of newspaper. Burn all waste promptly.
3. Recoat as often as needed.
4. Use No. 2 steel wool and denatured alcohol for the final clean-up. Never use gasoline, benzine, or turpentine for this purpose.
5. Wash thoroughly with alcohol and burlap or bagging. Wipe dry with clean rags. Use a wooden picking stick on all panel lines and moldings.
6. Use a scratch brush or a fiber brush carefully to clean all carvings.

POPULAR SCIENCE MONTHLY SHOP DATA FILE

Homemade Adjustable Drawing Board Has Two Perspective Vanishing Points



The board can be set at various angles but the shelf remains level



THIS adjustable drawing board with special vanishing points for perspective sketches will accommodate drawings up to 18" square. The board is adjustable for three different angles and folds flat to a thickness of only 3". The shelf remains horizontal regardless of the angle used. The vanishing points can be swung to 40 deg. either way from the horizontal and slide beneath the drawing board when not in use.

The whole unit can be made of ordinary pine with the exception of the drawing board, for which sugar pine or basswood is preferable. The base measures 18" by 22". The notches for the support are made by clamping the edges of the upper and lower brackets together and boring 3/4" holes in the center at their designated points.

It is important, if the shelf is to be kept level, that the hinges be mortised in and that

At each side of the board are movable arms into which pegs are inserted when necessary to act as vanishing points for making perspective drawings

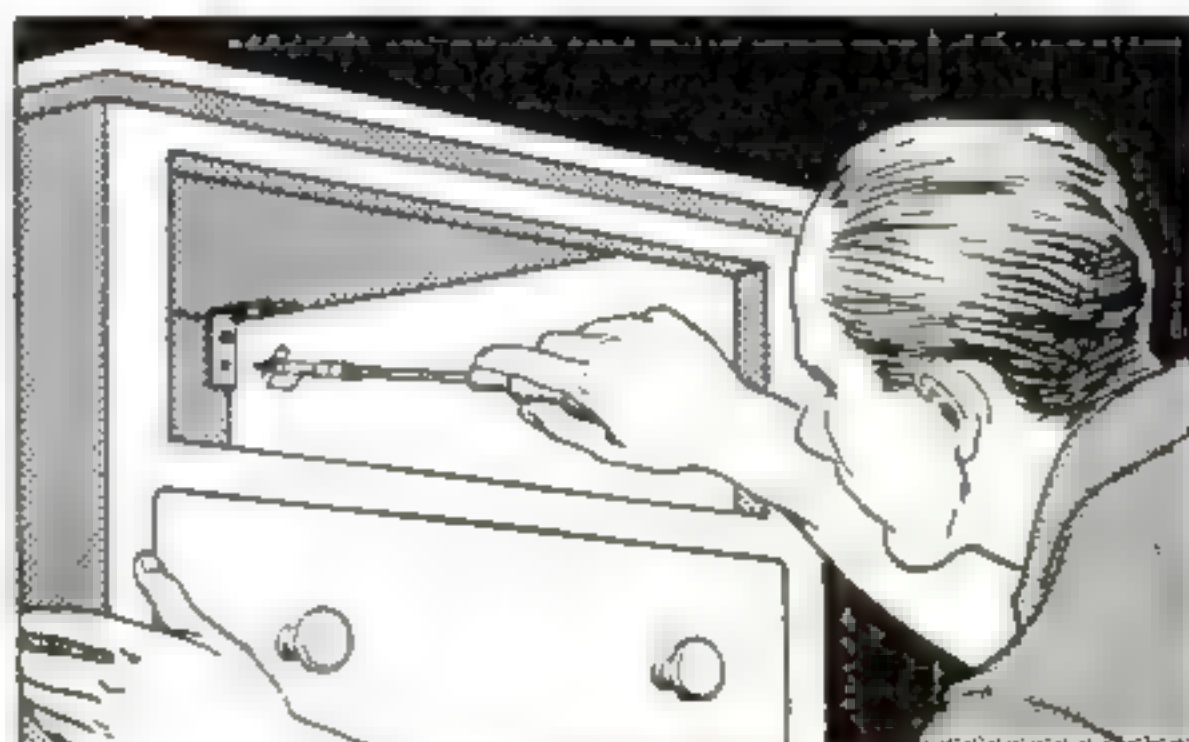
the lower and upper pivot screws in the shelf adjuster are at equal distance from hinges as indicated. Make the movable support for the drawing board by using 3/4" dowels for the four parts. The vanishing-point arms have a 1/4" slot cut in them and must be connected to the upper brackets with 1" bolts and wing nuts before fastening the brackets in place on the drawing board. The two pegs for the arms are 2" long and tapered from 3/8" to 1/4".—FRANK HEGEMEYER.

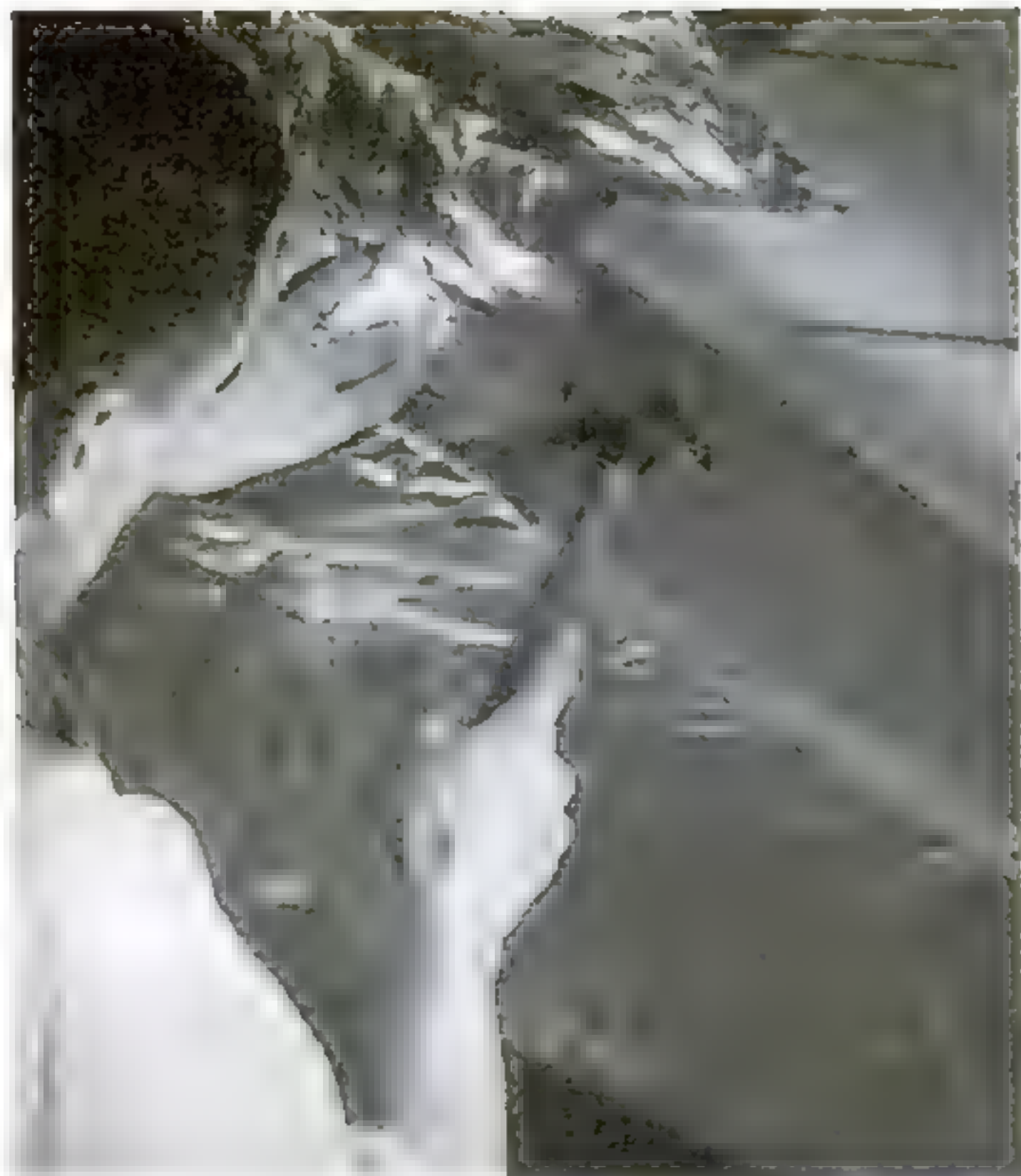


Wire Holder Aids in Starting Screws in Awkward Places

WHEN it is necessary to start screws in places that are hard to reach, a device for holding them on the end of the screw driver can be made as shown from a piece of wire or a paper clip and some friction or adhesive tape.

Have the holder in position when the tape is applied. Two or three thicknesses of tape are sufficient, and these should not be applied too tightly. The open loop permits the holder to be removed from the screw; and if desired, the holder may be removed from the screw driver while the screw is being tightened.—E. E. S.





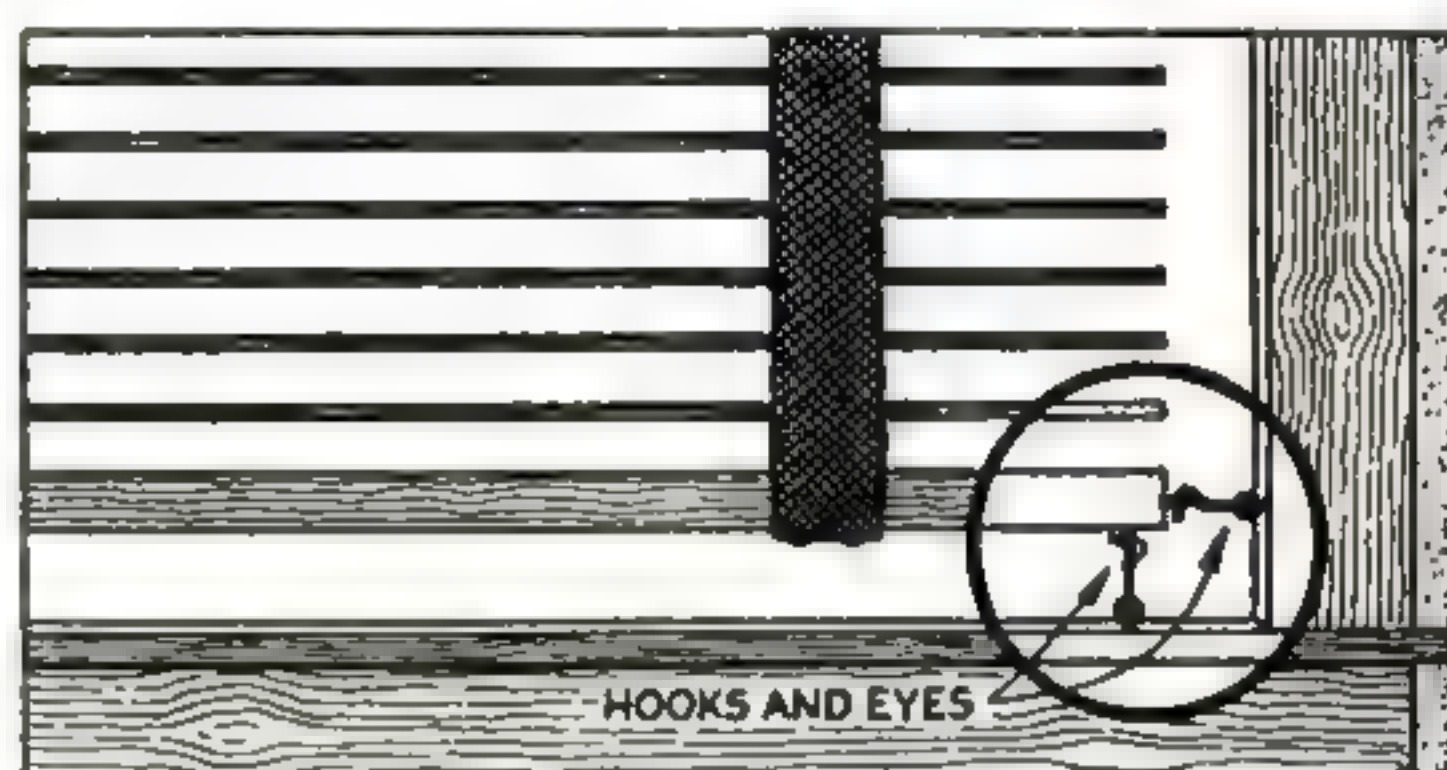
Aluminum Foil Chases Gloom from Dark Basement Shop

COVERING a basement ceiling with aluminum foil greatly increases the light, both in the daytime and when artificial illumination is used. The foil is more permanent than any form of paint, as it tarnishes extremely slow-

ly. The writer happened to have on hand a quantity of this foil, which was removed from large, used tea chests, but aluminum foil is now easily obtainable from building supply houses.—R. O. L.

Preventing Venetian Blinds from Swaying in Wind

WHEN Venetian blinds have a tendency to sway in the wind, a small hook and eye placed on each side in either of the two positions shown below in the drawing will prevent this and permit the blinds to be closed even if it is blowing a gale. The eyes should be approximately centered in the ends of the lowest crosspiece so that the hooks will reach, regardless of the way in which the slats are turned.—R. C. R.



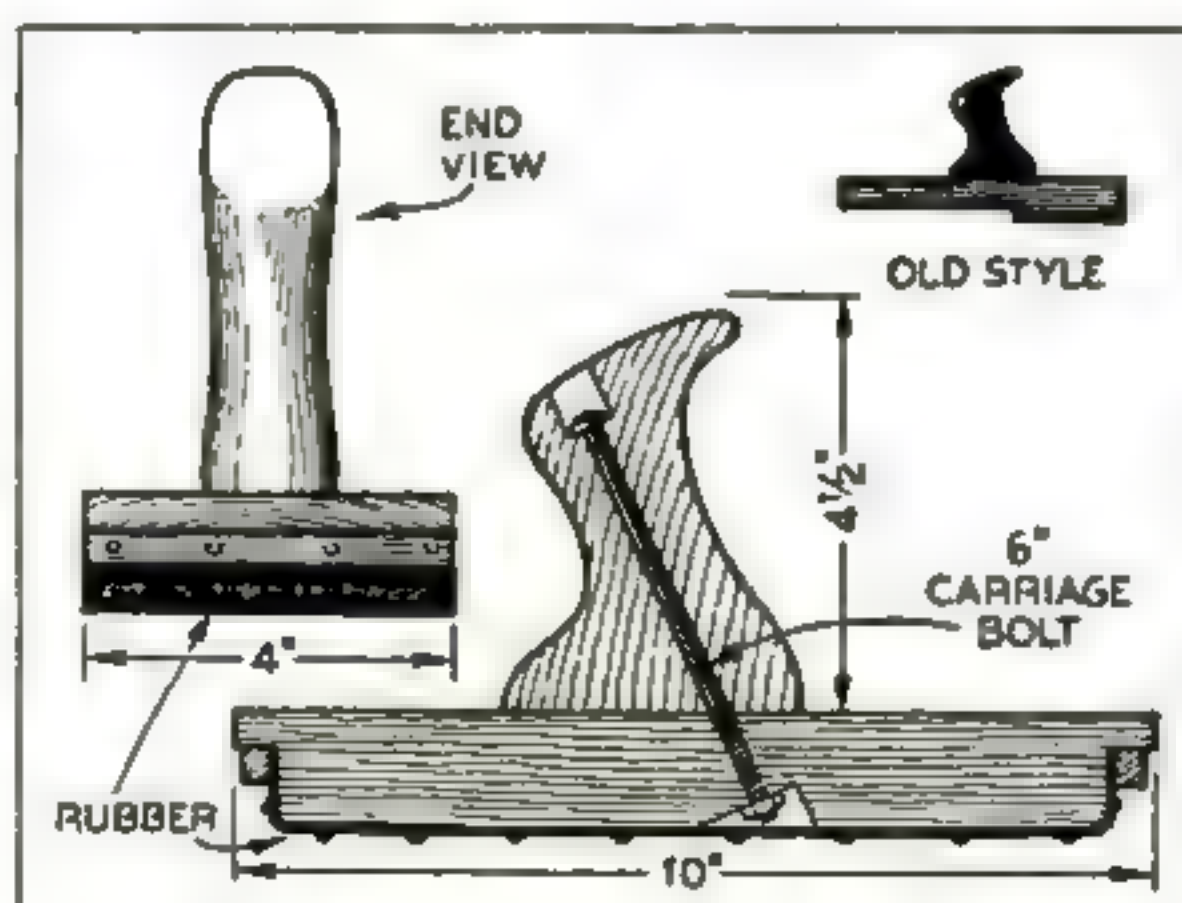
Either arrangement will hold the blind in place

Improved Jointer Pusher Has Ribbed Rubber Face

FOR ease of operation, convenience, and safety, this variation of the usual pusher block for use in planing lumber on the jointer is well worth the little time necessary for its construction. It will also be found useful in ripping wide pieces on the bench saw.

The pusher consists of a block 1" by 4" by 10" with one side covered with ribbed rubber sheeting, and a wooden handle. Unlike the old-style pusher, it can be used on lumber of any length.

Scrap lumber will suffice, although maple or other hardwood is desirable for the handle to prevent splitting. The rubber sheeting is cut from a discarded sink pad. Cement the rubber (with ribs running crosswise) to the bottom of the block and nail the ends into the notches through a narrow stick to prevent the nailheads from tearing the rubber. When applying the rubber, stretch it slightly to increase its grip.—LECIL J. SLABACK.



Unlike the old-style pusher, this variation can be used with lumber of any length. The ribbed rubber sheeting is obtained from a discarded sink pad



Nut Arbors and Collars Made at Low Cost

NUT arbors, which are somewhat expensive, can be made with little difficulty even by amateur machinists. The one illustrated is a $\frac{3}{4}$ " arbor, the materials for which should not cost more than fifty or sixty cents.

Materials: 1 pc. carbon tool steel (1.00 to 1.10 carbon content) 1 $\frac{1}{16}$ " diameter, $6\frac{7}{8}$ " long, and 1 pc. seamless steel tubing, 1" diameter, $\frac{3}{4}$ " bore, and 5" long.

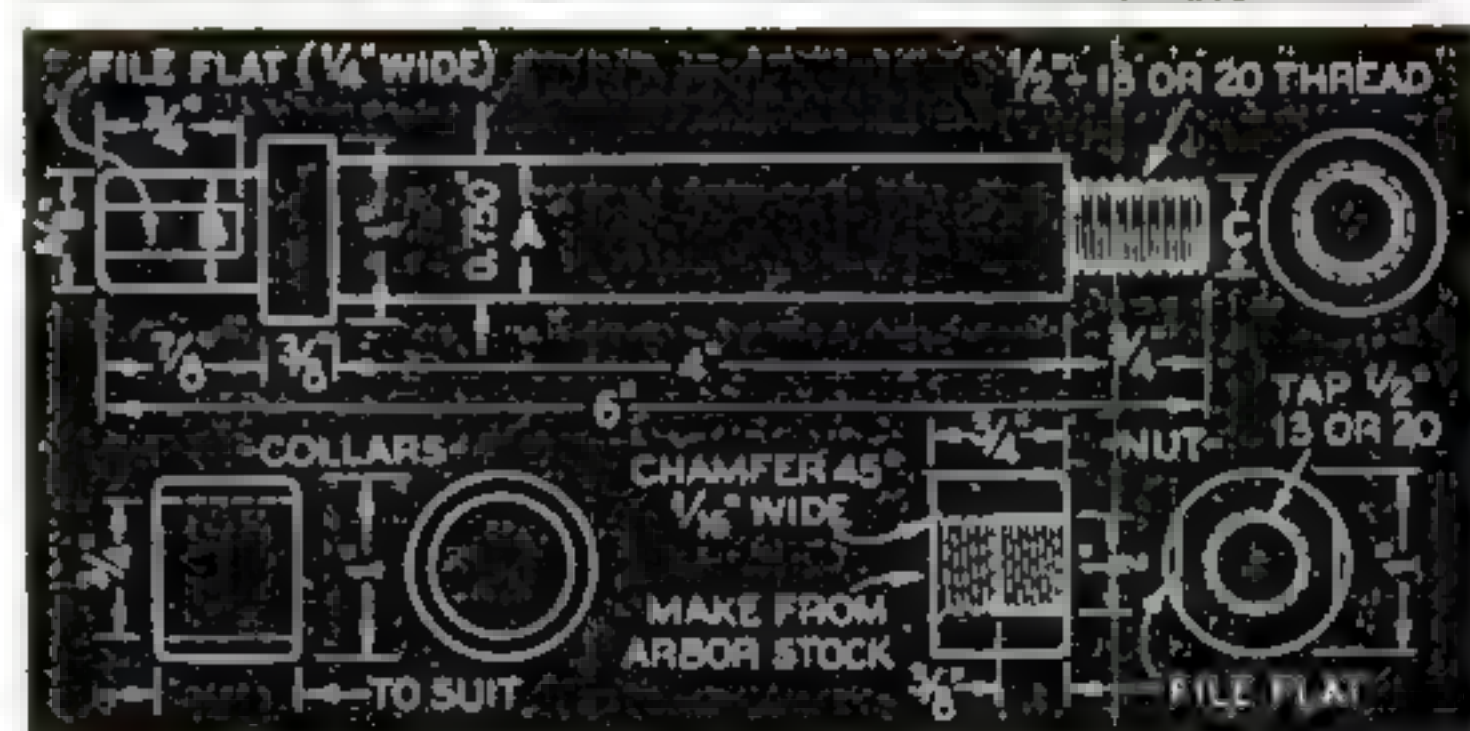
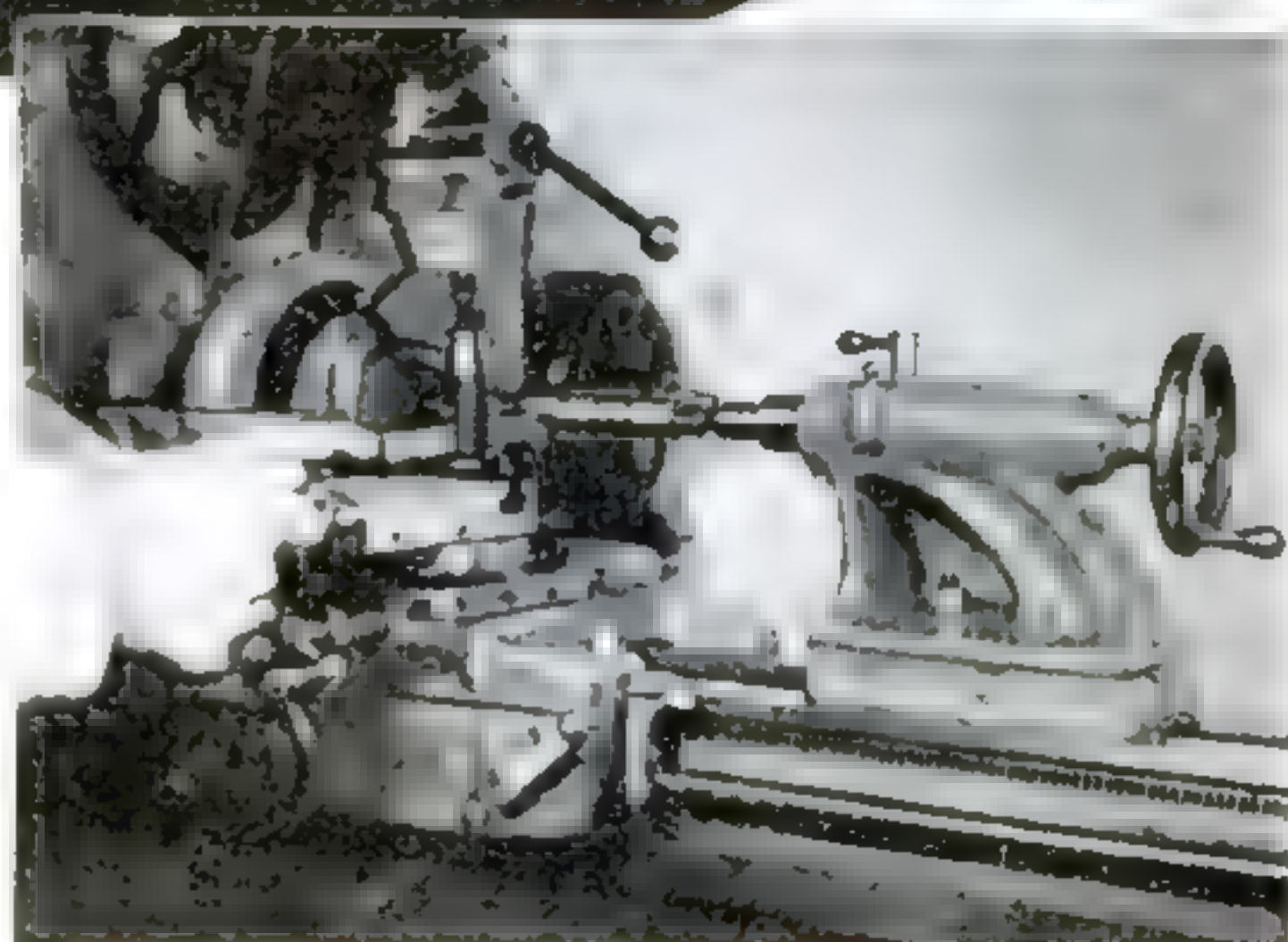
Cut piece for nut from arbor stock. Turn arbor, the only important section being that marked A. This should be perfectly straight and left 0.001" oversize for the present. File flat on end B, and thread end C carefully with a die.

Mount tubing on a mandrel, which may be turned from scrap to $\frac{3}{4}$ ", but leave a short section of the back end 0.002" oversize for a drive. Cut collars any width desired, but file the corners before taking each cut through. The cutting-off tool automatically faces the sides parallel. After removing collars from mandrel, file off the burrs.

Nut arbors for occasional use need not be hardened all over. You can easily harden both ends with a blowtorch. Bring the extreme ends to a bright red and quench quickly by immersing in a vertical position. Then lap and polish section A to size.

Face the outer side of the nut stock, drill, and tap. File both flats and screw nut on arbor from the faced side in order to face the opposite side. If preferred, a regular hexagon nut will serve the purpose. The arbor can even be made in a woodworking lathe, if equipped with a large compound rest.

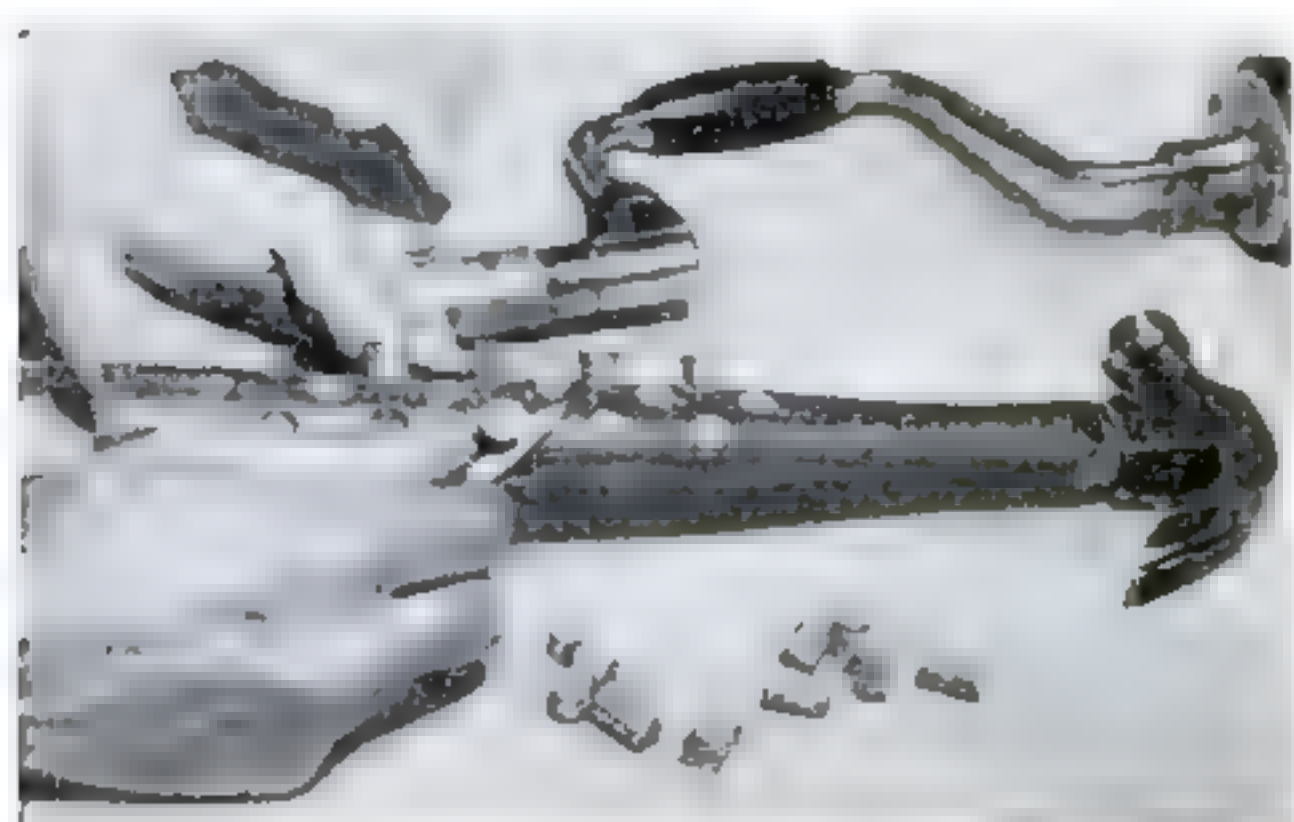
Above, hardening ends of the arbor by heating with a blowtorch



Drawings of the parts. Above, cutting-off seamless steel tubing into arbor collars of various widths

Corks Glued in Hammer Handle Provide Nonslip Grip

TO PROVIDE a good hammer grip that will prevent slipping, drill holes in the handle $\frac{3}{8}$ " deep, using a $\frac{3}{8}$ " bit. Drop a bit of glue into each hole, insert corks that measure $\frac{3}{8}$ " in diameter at the small end, drive them in, and cut off the surplus. If the corks are left projecting very slightly, an even better grip is provided. It is best to drill the holes in a pattern.—BENJAMIN NIELSEN.



After holes are drilled in the handle, corks are driven in and trimmed to project slightly

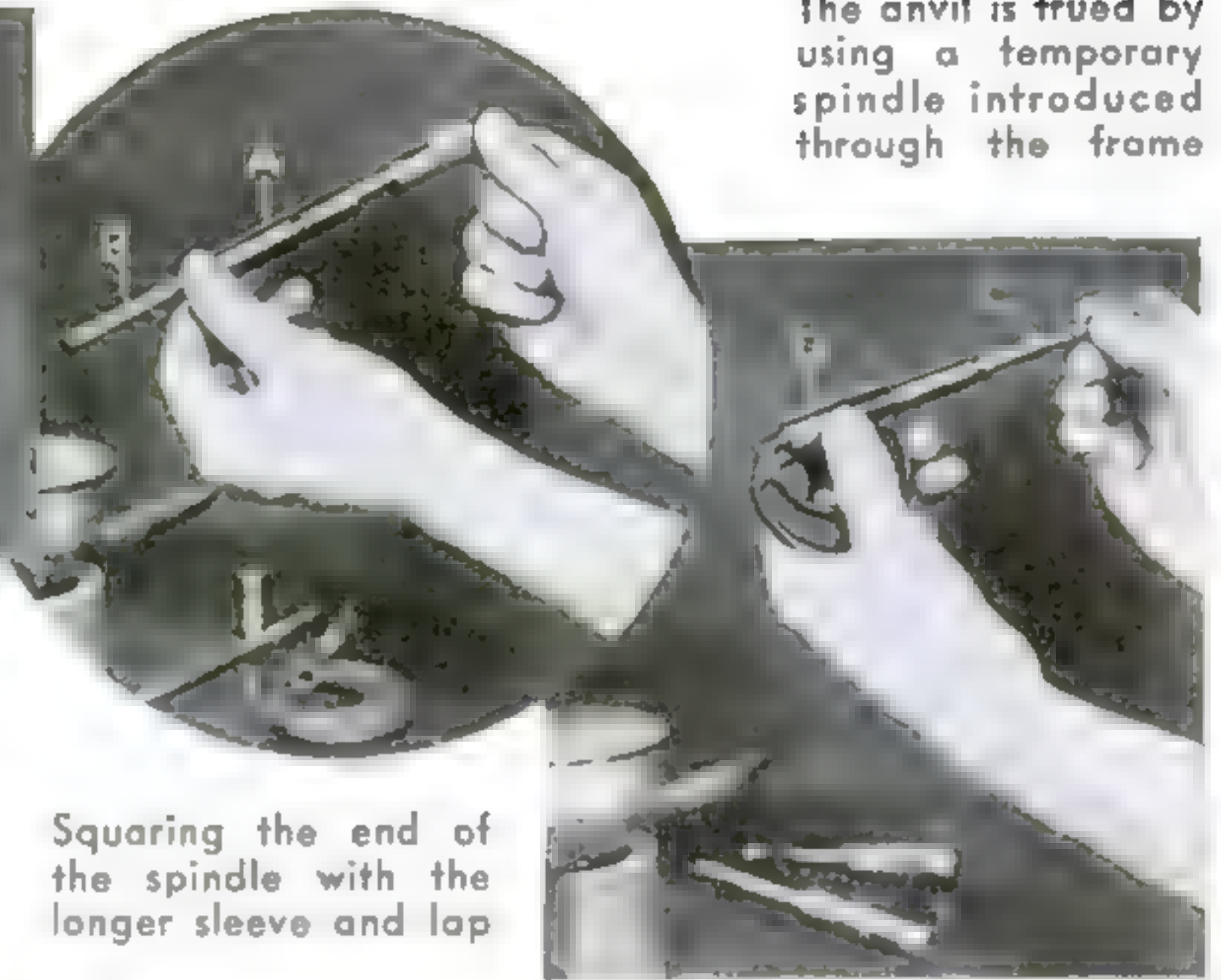
Lapping "Mikes" to Restore Accuracy



The four parts of the lapping set. A and B are used for the spindle, C and D for the anvil

MICROMETER calipers eventually reach a point when they have to be reconditioned, unless their future use is intended for rough measurements only. Merely taking up the wear of the screw does not correct all ills because the contact points get their share of wear. A simple lapping procedure, however, will square the ends of anvil and spindle. For this purpose it is necessary to make a lapping set of four parts from drill rod, as shown at the left above.

The spindle is removed from the micrometer calipers and squared by inserting it in one end of the sleeve A. The lap B is inserted in the other end of the sleeve with a light pressure and an oscillating motion. A small amount of fine lapping compound is applied to the end of this lap at short intervals; the cross hole in the sleeve is only for



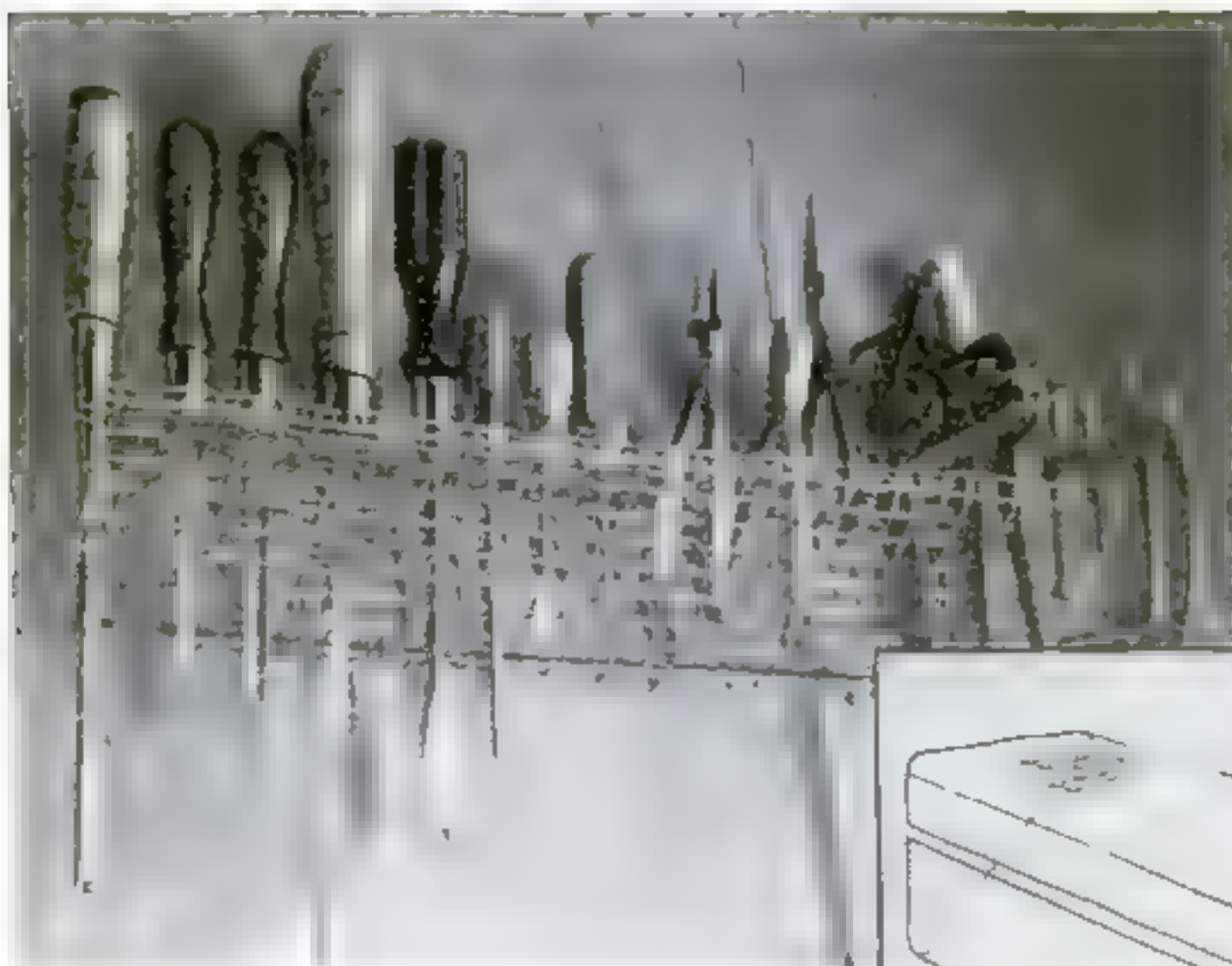
Squaring the end of the spindle with the longer sleeve and lap

observing how the procedure is progressing.

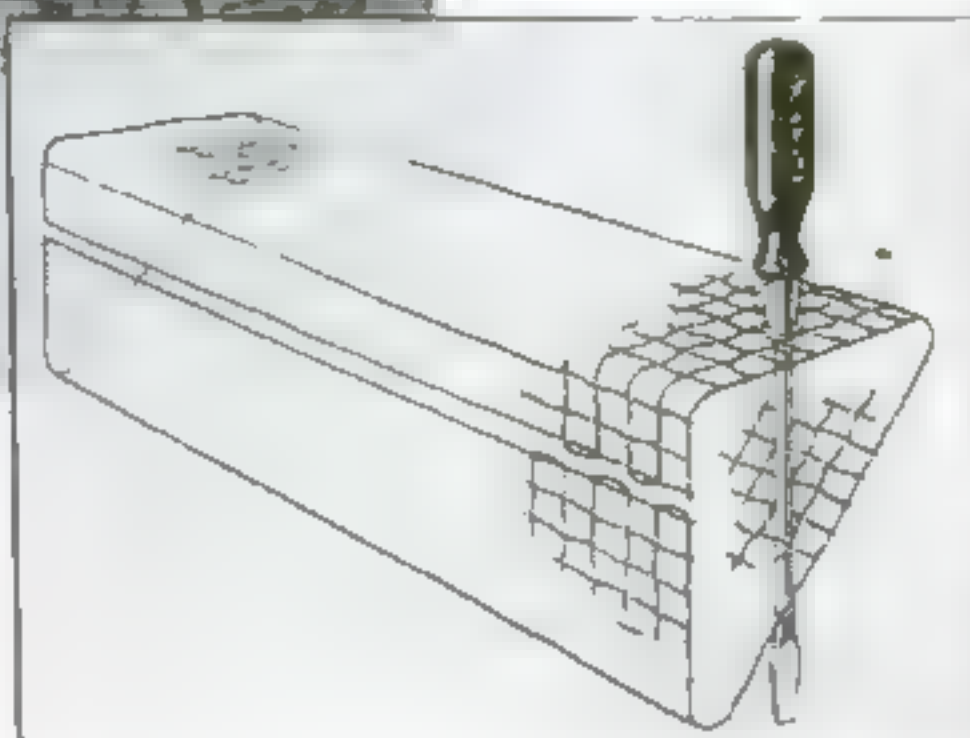
The anvil is squared by means of an improvised spindle C and the lapping sleeve D. Spindle C is inserted through the bore of the frame and lines up the lapping sleeve, which is, of course, bored blind to within $\frac{1}{8}$ " of the end. The compound is applied to the end of the sleeve, which is oscillated with the thumb and index finger of the left hand while exerting a light pressure from the spindle with the right hand.

This lapping outfit can, of course, be used repeatedly, provided the ends of the laps are kept perfectly square with their respective working surfaces.—H. J. CHAMBERLAND.

Hold-All Tool Rack Bent from Heavy Wire Mesh



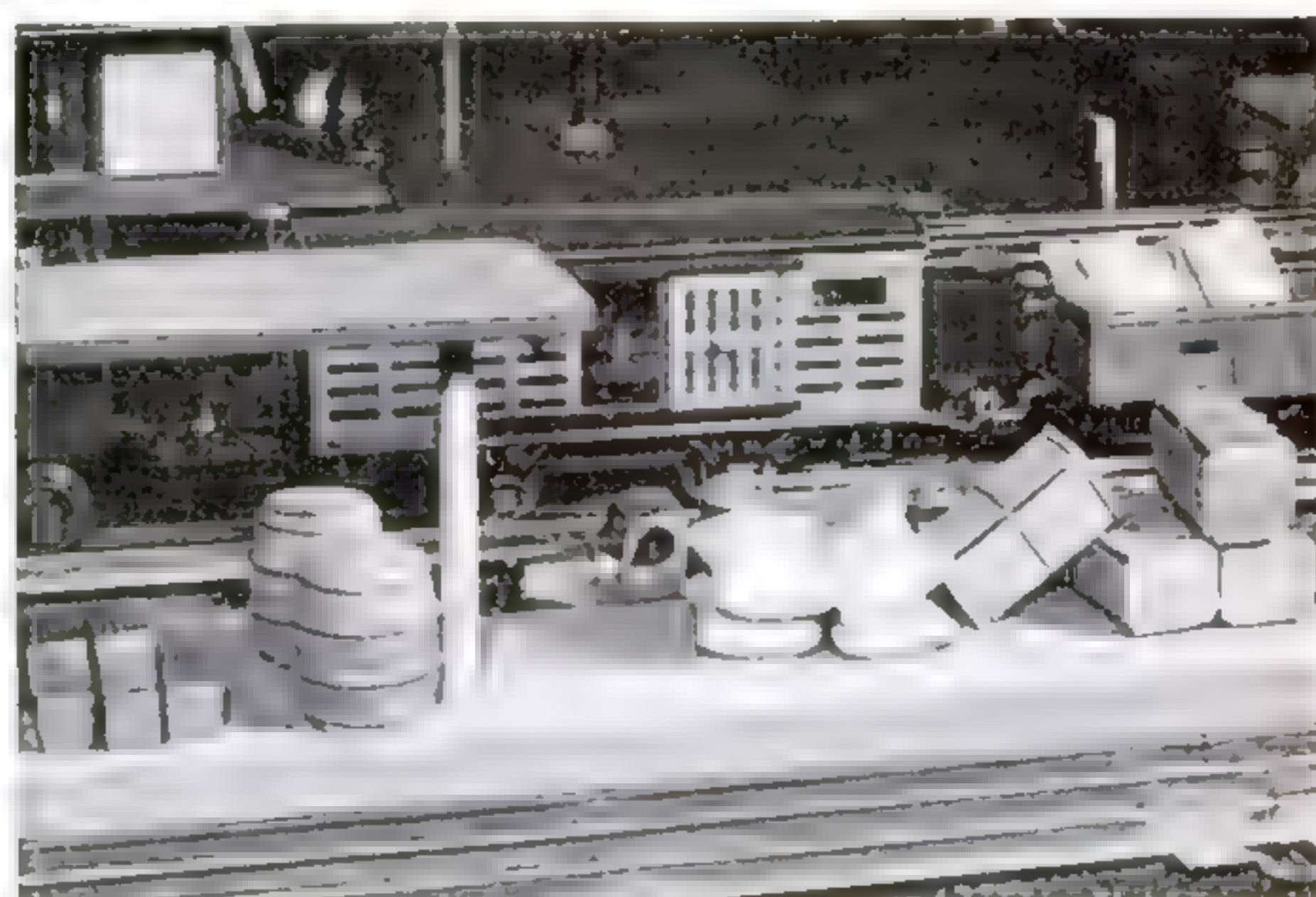
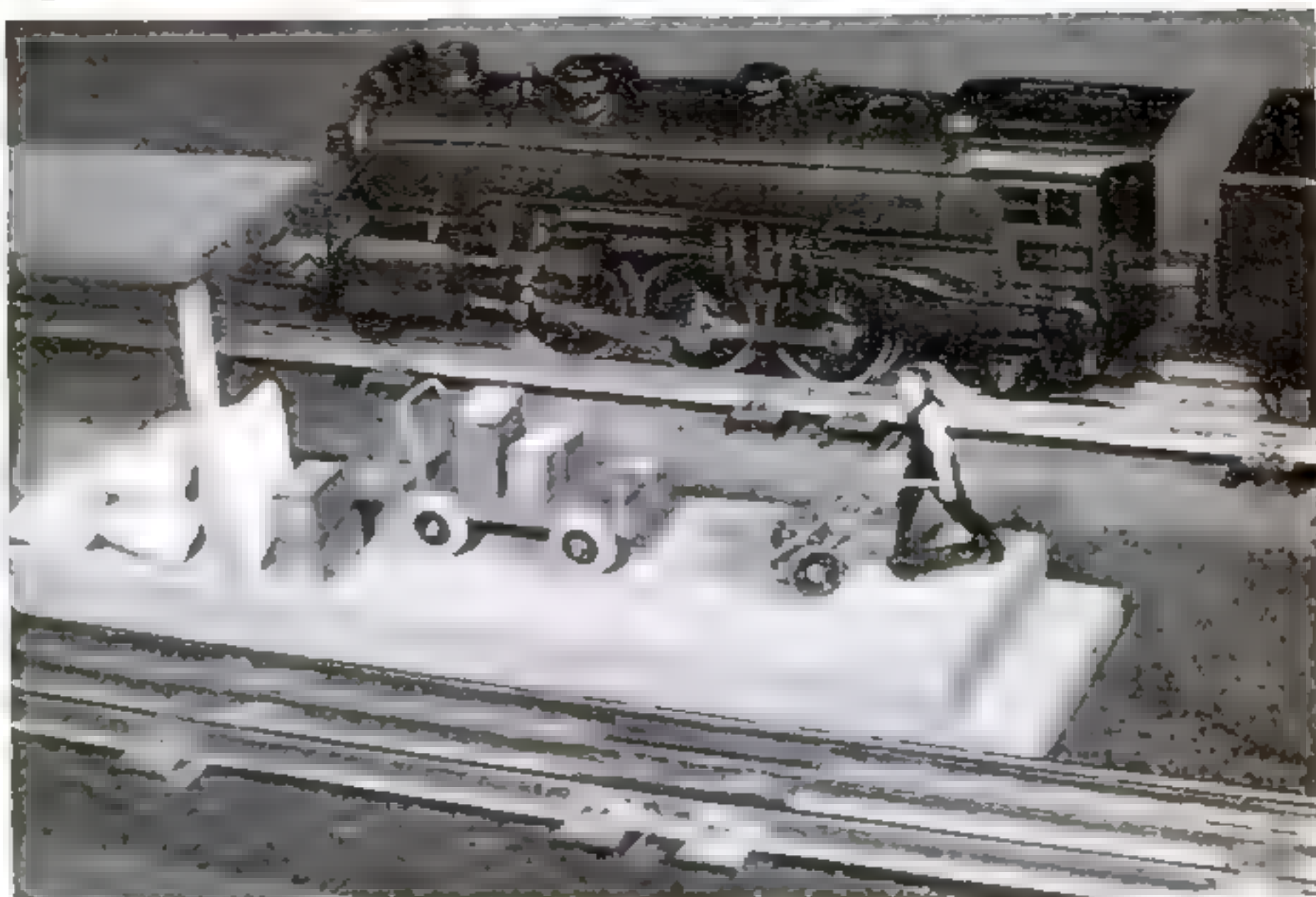
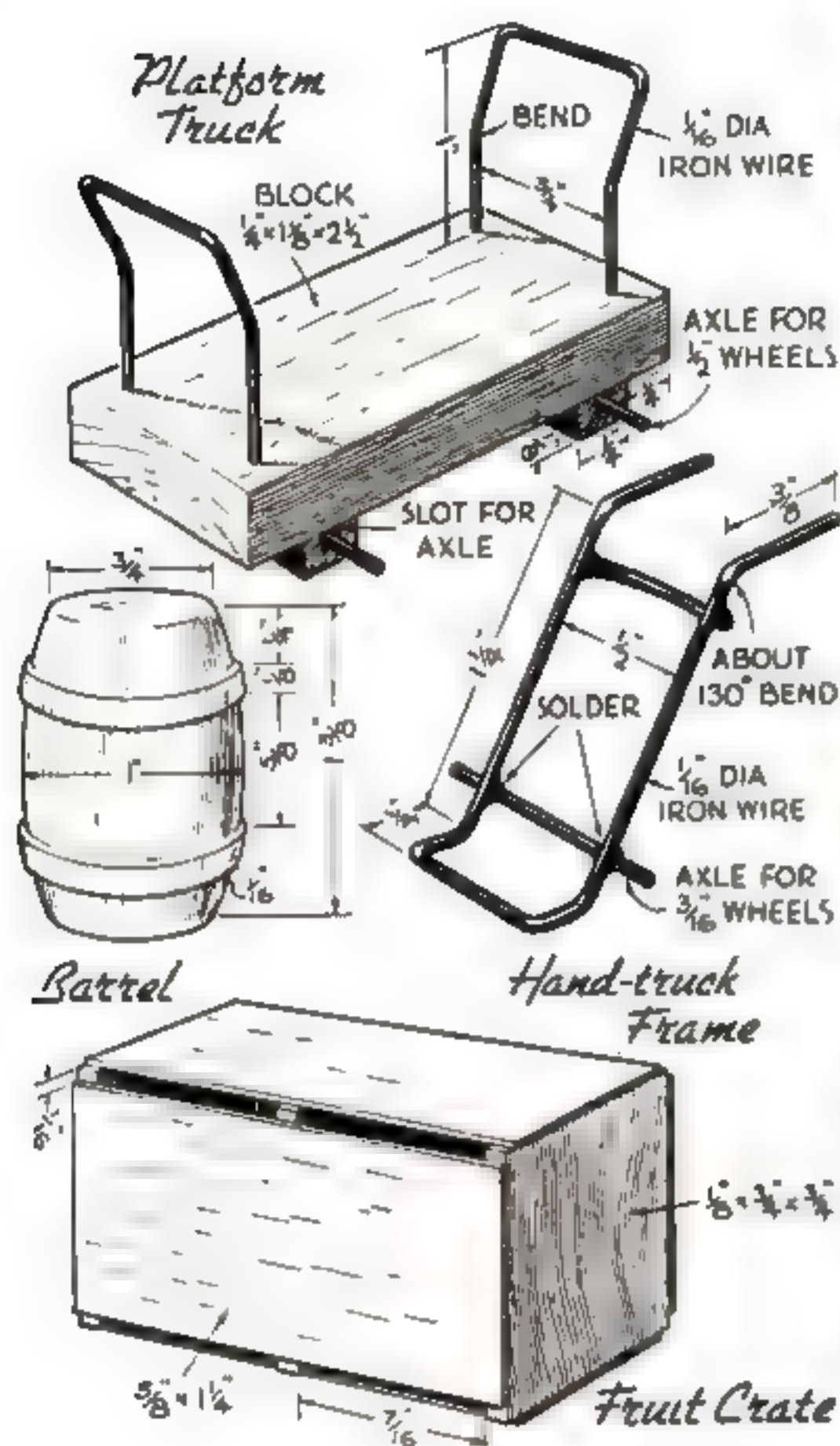
A large variety of small tools may be kept neatly in this rack, which is bent from a piece of $\frac{1}{2}$ " hardware cloth as illustrated at the right



BENT from $\frac{1}{2}$ " mesh wire, this tool rack seems to be unlimited in its capacity for holding pointed tools. It enables one to keep the workbench cleaner, does not collect dust, and at the same time is neat in appearance.

A rack of the size illustrated requires a piece of 12" by 20". Hold the wire firmly on the edge of the bench and make a lengthwise bend 1" from one edge, another bend $3\frac{1}{2}$ " from the first, parallel to it, and a final bend $4\frac{1}{2}$ " from the second bend. By this method the two selvages of the mesh will meet at the back of the rack, and that part is tacked to the wall with staples. Wherever tools with blades wider than $\frac{1}{2}$ " are to be inserted, one or more of the wire strands may be snipped away, as can be seen in the photograph at the left.—JACK ANTHONY.

Model-Railway Baggage and Freight



Miniature barrels, bags, boxes, and crates ready for shipment by freight. Above, hand and platform trucks lend additional realism

YOU can add to the picturesqueness of your model railway system by making the baggage and freight accessories illustrated. The sizes given are suitable for 0 gauge.

To handle the baggage on the platforms, the platform truck is assembled as shown above and fitted with rubber-tired wheels taken from a small toy. Before attaching the wood strip under the frame, cut a groove the entire length of the strip to take the axle. The wire handles are set into holes bored through the wood body.

The framework of the hand truck is shaped from a single piece of wire and becomes rigid when the axle and top crosspiece are soldered in place. Use solid metal wheels on this truck. Paint the bodies of both trucks gray and the wheels black.

Boxes are made from $\frac{3}{4}$ " lengths of $\frac{1}{2}$ " square wood strips and from $1\frac{1}{4}$ " lengths of $\frac{3}{4}$ " square strips. Leave the boxes in the natural finish, and with a pen and drawing ink place small dots around the ends to indicate nails.

For the sacks, sew together two pieces of thin cloth 1 " by $1\frac{3}{4}$ "

along three edges, turn inside out, and fill with sand or salt. The open end is then sewed shut. Use white cloth to represent flour or cement bags, and brown for sandbags.

The small wood barrels are turned on a lathe, or pieces of round wood may be shaped with a wood rasp and sandpaper. For each fruit crate, glue four strips of thin wood, obtained from berry boxes, to three wood squares, as shown in one of the drawings, and twist pieces of No. 22 bare wire around the crate at the ends and center to hold the pieces together.

While not illustrated, strips of lumber for the gondola cars are cut $\frac{3}{16}$ " by $\frac{1}{2}$ " by 6 ", $\frac{3}{16}$ " by $\frac{7}{8}$ " by 6 ", and $\frac{3}{16}$ " by $\frac{3}{16}$ " by 6 ".—C. ELMER BLACK.



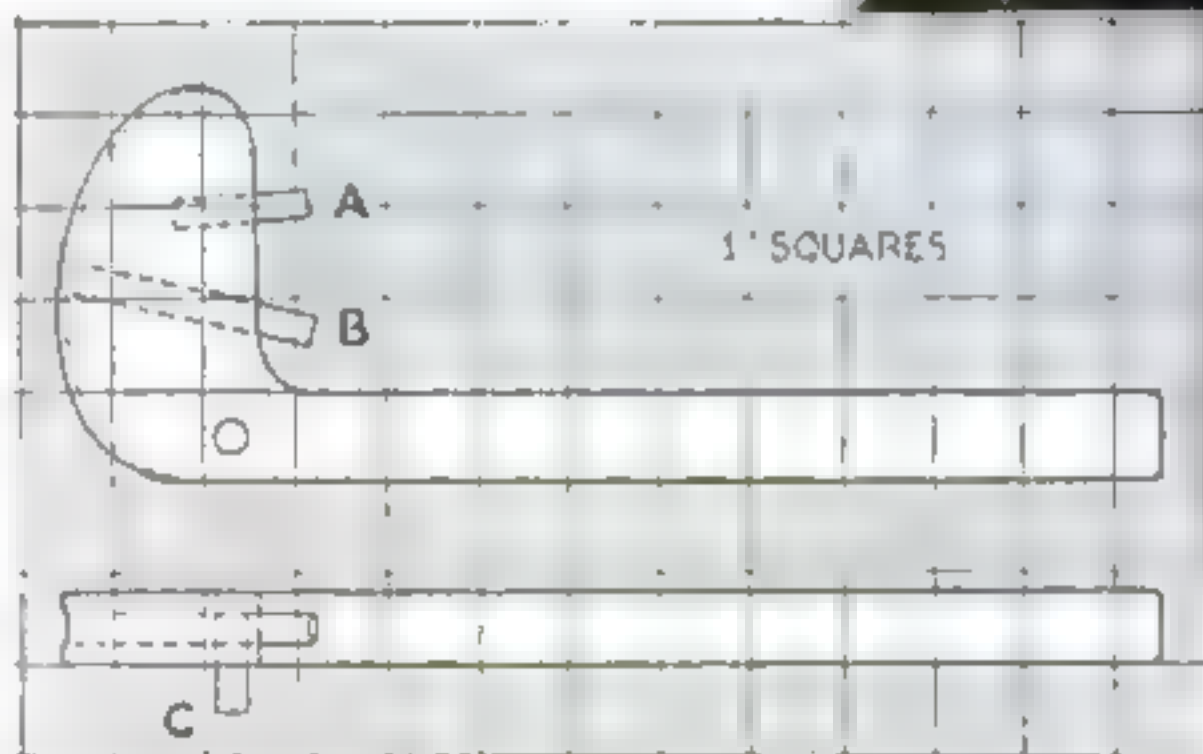
One drop of solder on end of axle holds each wheel in place

Tennis Rackets Restrung with Aid of Lever

MANY tennis enthusiasts would like to restring their own rackets, but find it difficult to pull the cross strings tight enough. With the aid of this simply constructed lever and no other equipment except two awls, anyone can do a professional job of restringing.

Cut the lever from a piece of $\frac{3}{4}$ " maple, chestnut, or other hardwood. If this stock is not available, a piece of $\frac{3}{4}$ " five-ply wood will serve just as well, although it is not quite as durable. Locate and drill the $\frac{3}{8}$ " holes as indicated, and glue in the dowels. With a spokeshave or a coarse file, round off the corners of the handle, and smooth it with sandpaper. Cut the groove in the bottom, which is to prevent the lever from slipping off the frame of the racket when in use, with a gouge or half-round file.

To use the lever, weave the gut between the warp strands, which have already been laid down, and bring it through the hole in the frame. Place the lever on the frame, near the hole where the gut comes through, and tilt it forward. Wind the gut around the pegs A and B two or three times, then several times around C and bring the loose end up along the handle so that it can be held firmly. Force the lever back until the string is taut enough, then place the awl securely



Pulling the gut tight. The tension lever is made as shown at left

in the hole so that the string will not loosen. Each string must be tightened individually.

The all-wood construction of the lever prevents the possibility of chafing or cutting the gut; and with it, rackets can be strung tight enough to get the full benefit of the resilience of new gut.—ARTHUR TANENBAUM.

Electric Shaver Kept in Wire Wall Rack

WIRE from a coat hanger is used for making this wall holder for an electric shaver. Two pairs of pliers, one flat and the other round-nosed, are required for bending the wire. If a razor of another make than that shown is used, it is merely necessary to change the lengths marked A and A'. The top section of the holder should be a loose fit so the razor rests on the bottom frame. The opening on the left side of the razor, between the holder and the wall, permits the electric cord to remain connected to the razor. Two small screw hangers, turned in toward each other, hold the other end of the cord in a convenient place adjacent to the electric outlet.—JEROME UHRIG.

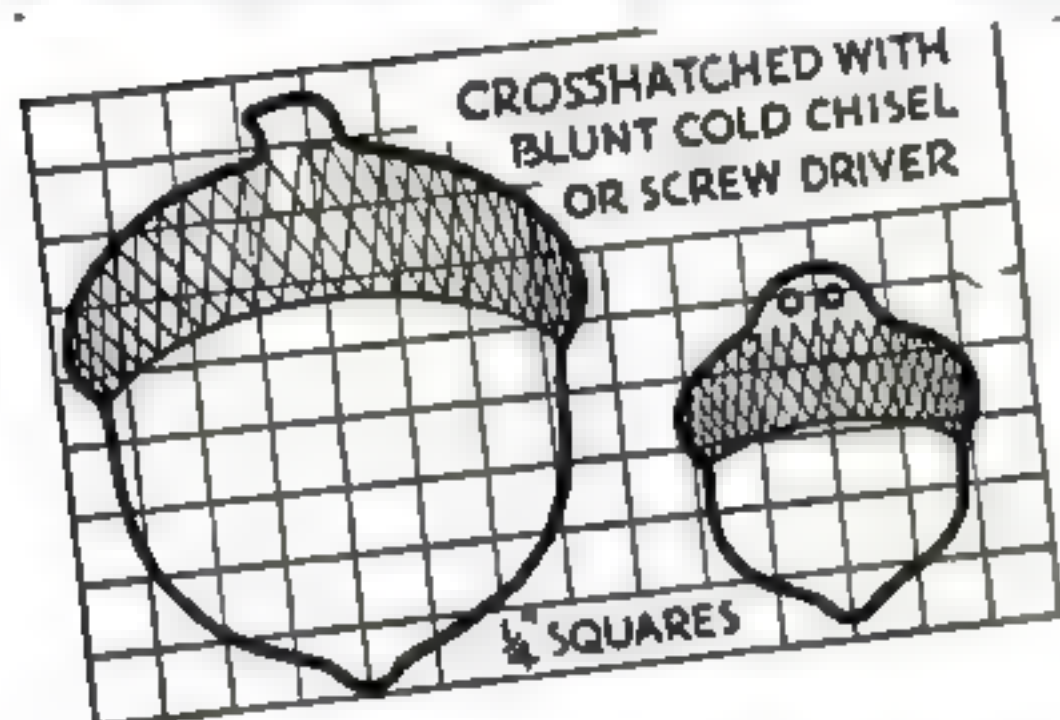


How wire is bent, and the completed rack with shaver



Acorn Brooch and Buttons

CUT FROM SHEET COPPER



After the designs are cut out with tin snips, they are finished with files and emery cloth

**By GEORGE
A. SMITH**

FOR sports wear, an acorn-shaped brooch and buttons to match may be cut out from sheet copper and oxidized to an autumn-brown color. A few scraps of about 18-gauge soft sheet copper and a fastener from a discarded brooch are the only materials needed.

Cut out the designs in the rough with a pair of tin snips and finish accurately with files and fine emery cloth or sandpaper. The crosshatching on the acorn cup is first marked with a lead pencil, then indented with

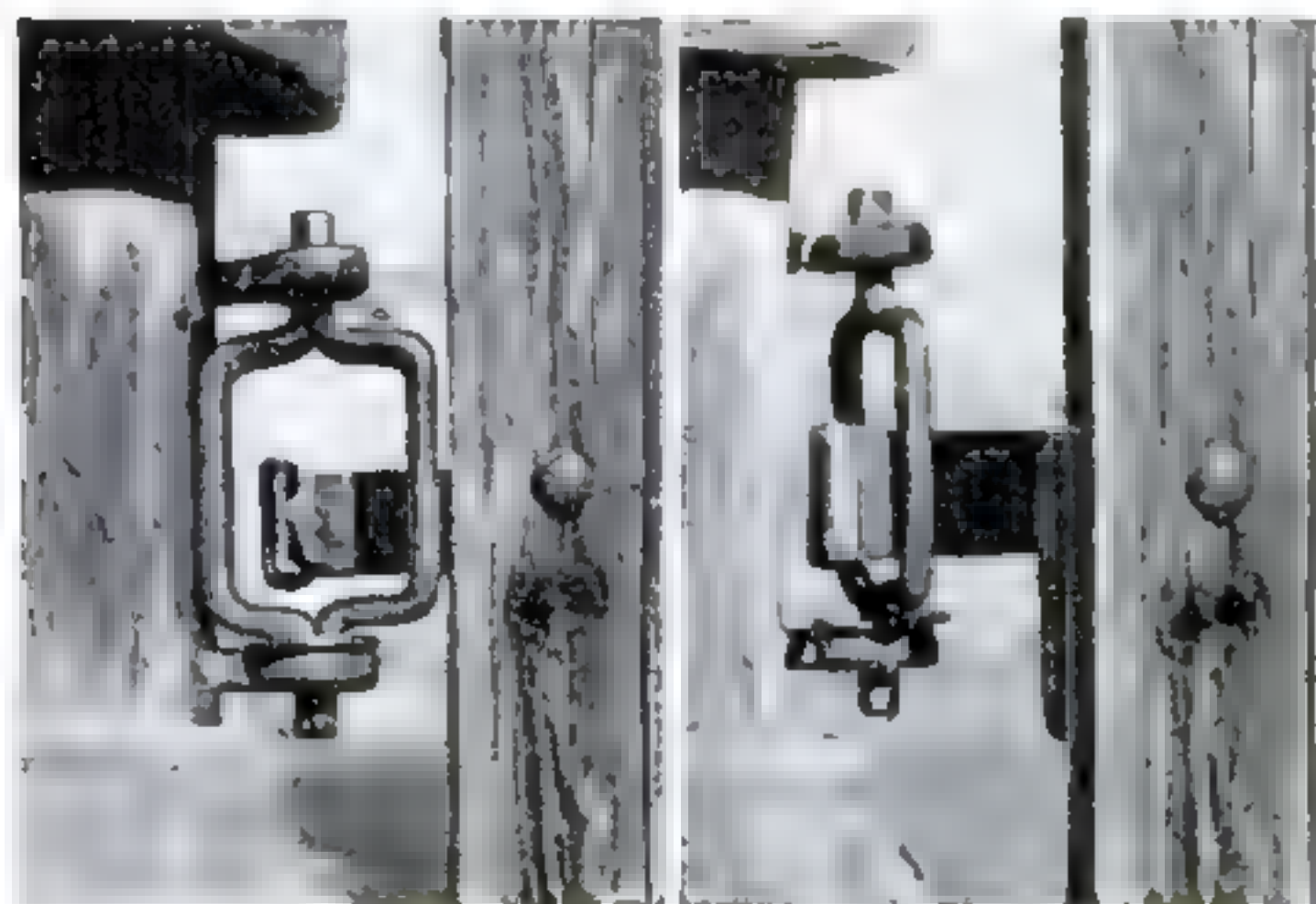
a blunt cold chisel or a screw driver that has been filed or ground to produce the desired effect. Two 1/16" holes are drilled as indicated in each button.

Remove the rough edges from the designs and planish them with a flat-faced hammer to harden the soft metal. Finally, dome the pieces slightly by placing them face down on a perfectly smooth surface and hammering the backs

of each with the ball peen of a hammer.

To oxidize the ornaments, lay them on a hot metal surface just long enough to cause the metal to take on a dark brown color. When they are cool, polish the metal with a cloth to bring out a rich luster.

The fastening device is attached to the back of the brooch with soft solder. The buttons may be used for purely decorative purposes, or they may be passed through button-holes.



Wrought-Iron Gate Latch Locks Automatically

ALTHOUGH excellent for any type of swinging gate, the homemade wrought-iron gate catch illustrated at the left is particularly handy for horseback riders because it can be opened and closed without dismounting. The catch can be turned to either side, as shown, and the gate pushed open. When the gate is swung shut, the iron bar hits one side of the open catch and throws it into the locked position.—MERRITT W. BRADSHAW.

Timely Tests for Home Chemists— After Analyzing These Beverages You Can Drink What You Have Left By RAYMOND B. WAILES

WOULD you like to know what's in your favorite soft drink? Testing bottled and homemade beverages offers an entertaining pastime for the owner of a home laboratory. By a happy coincidence, a liberal amount of each "sample" will be left over to refresh the amateur chemist on a warm summer's day.

A few test tubes, a beaker or two, and a small stock of familiar chemical reagents are all the equipment that you will need. You may choose the drinks to be tested according to your taste. A bottle of soda pop, a cup of tea or coffee, or a glass of lemonade will all yield their secrets to your chemical sleuthing.

Before you start to analyze a bottled soft drink, notice its color. If it is artificially colored, the label or bottle cap will say so. Harmless, certified aniline or coal-tar colors are used for this purpose, under strict Gov-

ernment supervision. Try boiling pieces of white cotton cloth, in a small beaker, with soft drinks of various flavors. You will find you can dye the fabric in corresponding colors.

Probably you know already that the "fizz" in bottled drinks is carbon dioxide gas—but can you prove it? One way is to heat a few fluid ounces of the drink in a flask with a one-hole stopper. Lead the issuing gas, through a glass tube and rubber tubing, into a beaker or flask of clear limewater. As the bubbles rise to the surface, white calcium carbonate or precipitated chalk will be formed, indicating the presence of carbon dioxide.

For another proof, half fill a glass with a carbonated beverage and let it stand in still air. The top of the glass will slowly fill with carbon dioxide gas, which is heavier than air. Lower a glowing splinter of wood into the glass. Since carbon dioxide does not support combustion, the glow will be extinguished.

Every bottle of a carbonated beverage is a bottle of carbonic acid, which is formed when carbon dioxide gas dissolves in water. To show this, make a weak solution of sodium carbonate in water. Add a drop of phenolphthalein solution, which will turn the liquid carmine red. Write on white paper with this red fluid, using a clean pen or a pointed stick. Before the water in the writ-



TEST FOR CAFFEINE IN TEA OR COFFEE

A white deposit formed on the bottom of a flask by heating the residue of a concentrated beverage is treated successively with two reagents. The resulting color changes indicate the presence of caffeine

Drink

ing dries, hold the test paper over an opened bottle of a soft drink, effervescing in lively fashion. The red writing will disappear. Any acid-forming gas, including carbon dioxide and sulphur dioxide, will produce this seemingly magical effect. Carbon dioxide dissolves in the moisture of the writing to form carbonic acid, and this converts the sodium carbonate into sodium bicarbonate, which does not turn phenolphthalein red.

The label or cap of a bottle will tell you whether the beverage is artificially flavored. Besides various organic chemicals so used, and cane sugar to impart sweetness, a fruit acid is usually added. This may be tartaric acid, which is found in grapes; or citric acid, the natural acid of lemons and other citrus fruits. Identifying either one is a simple matter of test-tube chemistry.

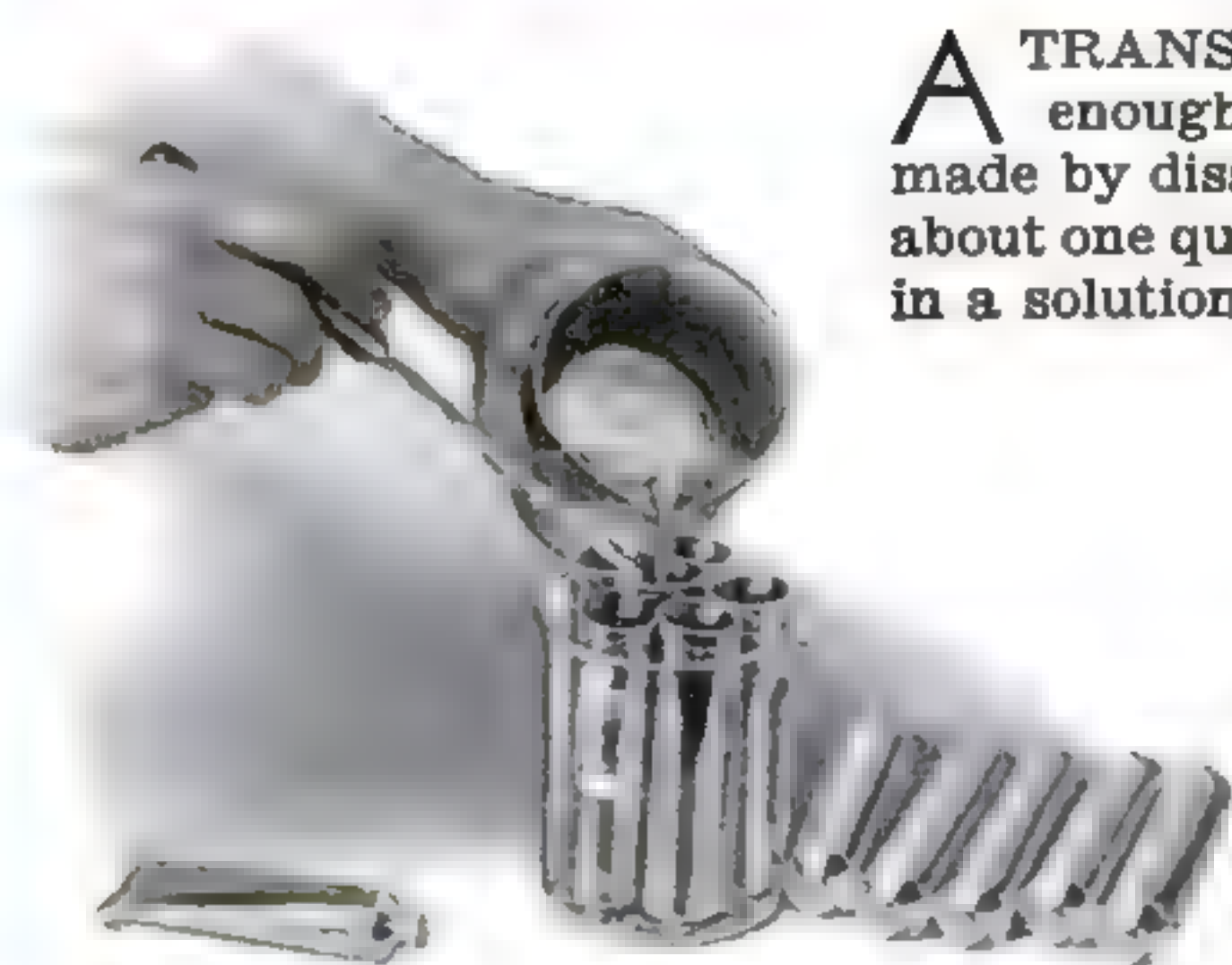
Place about five cubic centimeters of the beverage in a test tube, and shake it to remove the carbon dioxide gas. (One and a half teaspoonfuls roughly equals five cubic centimeters.) Add am-



Bottled soft drinks usually contain either citric or tartaric acid. A simple experiment will enable you to identify the acid

FLEXIBLE TRANSPARENT CEMENT

[FORMULAS]



A TRANSPARENT cement that is flexible enough to bend without cracking can be made by dissolving cellulose acetate, mixed with about one quarter of its weight of ethyl phthalate, in a solution of acetone (fifty parts), ethyl acetate (fifteen parts), ethyl lactate (twenty parts), and toluene (fifteen parts). Dissolve enough of the cellulose acetate and ethyl phthalate mixture in the solution to obtain the desired consistency. The cement can be packaged in collapsible metal tubes, as shown. Crimp the bottom ends of the filled tubes.

POPULAR SCIENCE MONTHLY SHOP DATA FILE

monium hydroxide, until the mixture smells strongly of ammonia; and then about half a gram (or a quantity the size of a pea) of ammonium chloride. Shake the tube to dissolve the solid chemical. Finally add about five cubic centimeters of a solution of calcium chloride, made by dissolving ten grams of calcium chloride in ten cubic centimeters of water. (A teaspoon holds about five grams of a solid chemical, with the exception of heavy ones like mercury compounds.) Shake the tube again and let it stand for half an hour or so. If a white crystalline precipitate forms, the beverage owes its tangy acidic flavor to tartaric acid. In case no precipitate forms, tartaric acid is not present.

CITRIC acid may have been used, instead of tartaric acid, as the acid ingredient. Filter the liquid from the tartaric acid test, mix it with two or three times its own volume of ethyl (grain) alcohol, and let it stand for several hours. This time, if a white precipitate forms, citric acid has been used in making the drink. The two white precipitates formed from tartaric and citric acid are, respectively, calcium tartrate and calcium cit-

rate. Both are easy to see in the tests.

You can also test a beverage directly, for citric acid, with what is known as Denigès mercuric sulphate reagent. To make this preparation, dissolve about five grams (half a teaspoonful) of red mercuric oxide by boiling it in a mixture of twenty cubic centimeters of strong sulphuric acid and 100 cubic centimeters (a scant half-glassful) of water. Add ten drops of this mercuric sulphate reagent to a test tube containing about five cubic centimeters of the beverage to be tested. Boil for one or two minutes. Now add, drop by drop, a two-percent solution of potassium permanganate until the mixture is decolorized; or, if you are testing a lemon or lime drink that has little color, until the addition of the permanganate just begins to form a permanent purple color. If a white precipitate forms at this point, then citric acid is present.

Lemon juice, lemonade, or a bottle of lemon pop will all give "positive" reactions in either of these two tests for citric acid. Likewise, grape drinks usually will give an affirmative result in the test for tartaric acid. The tests just described may also be applied

Homemade Heater for Evaporating Liquids

AN ELECTRIC-LAMP bulb supplies mild heat, in the convenient home-laboratory evaporating aid shown here, for removing remnants of water from concentrated liquids, pastes, or solids. The bulb, of forty-watt rating, is inclosed by a tin can with both ends removed. A rubber grommet encircles a hole in the side that admits the electric cord. Two L-shaped supports of metal, bolted to the can, secure it in place upon the baseboard, as shown in

the photograph below. To give the heater a neat, professional-looking appearance, you can apply a coat of "wrinkle finish" or crystallizing lacquer as a finishing touch. The apparatus will be a useful addition to your equipment.



How a tin can and an electric-light bulb are combined for an evaporator





A little research in tea brewing proves that the longer tea is brewed, the more tannic acid is extracted to grapefruit juice, orange juice, and pineapple juice.

Some soft drinks, like many natural fruit juices, contain phosphoric acid. When flavored phosphate drinks are served at soda fountains, a solution of phosphoric acid is shaken into the drink before the carbonated water is added.

To test a bottled beverage or a natural fruit juice for phosphoric acid, mix about five cubic centimeters of the liquid with several cubic centimeters of a strong, filtered solution of ammonium molybdate. Add several cubic centimeters of nitric acid, and boil the mixture. If a yellow precipitate forms, phosphoric acid is present. You will find that soft drinks of the cola type will give a positive reaction for phosphoric acid. Fruit juices and many other beverages prepared from natural products will also do so—including tea, coffee, and coffee substitutes, which consist mostly of roasted cereals. To test any such solid substance for phosphoric acid or phosphates, heat it at red heat in a crucible or evaporating dish, until it is completely converted to a white ash. When the dish has cooled, dissolve the ash in nitric acid. (CAUTION: if the dish is hot, the acid may vaporize and spatter dangerously. Make sure it is cool to the touch before adding the acid.) Add ammonium molybdate solution to the acid solution of the ash, and boil. A yellow

precipitate, as before, indicates the presence of phosphoric acid or a phosphate.

Ash from coffee, tea, or the coffee substitutes can also be shown to contain potassium. Make a very small loop in the end of a clean piece of nichrome or platinum wire, moisten it, and touch it to a speck of the ash. Hold the loop in the blue Bunsen flame. If the ash imparts a violet color to the flame, then potassium is present in it and in the vegetable matter from which it came. In case the flame is tinted yellow, the violet color will be masked and can be observed only by viewing the flame through blue glass, but this will rarely be necessary.

COFFEE, tea, the cola drinks, and maté (Paraguay tea) contain caffeine, a mildly stimulating alkaloid. You can detect caffeine by an interesting color reaction called the murexide test, which is easily performed in spite of its complex chemical nature.

Dissolve five grams of lead acetate in about fifty cubic centimeters (three tablespoonfuls) of water. Add this solution to a strong brew of tea, prepared without sugar. The lead acetate removes the tannins and some other substances, forming a muddy precipitate which should be filtered off. Place the clear filtered solution of tea in a beaker, boil it down to a volume of about twenty cubic centimeters (a little *(Continued on page 218)*)

Easy Tests Illustrate



All Yellow Flames Are Not the Same

ADJUST a Bunsen burner to give a low, yellow flame. Under this light, objects closely retain their natural colors. Now tint a blue Bunsen flame yellow by inserting a bit of borax—a sodium compound—adhering to the end of a wire. By this light, any objects but yellow ones lose their color completely. To the eye, the “natural” and “sodium” flames seem alike in hue. Actually the first is a composite of all colors, but a slight deficiency in violet and blue makes it appear yellow; while the second is a pure yellow, with all other colors missing.

By the sodium-tinted flame, only yellow objects retain their color

Potential vs. Capacity

TO A sheet of tin foil fastened on glass rods, as shown, attach two pith balls or gold-leaf strips. Silk threads guide the lower rod. Roll up the tin foil like a window shade, and charge it with static electricity. The balls or strips repel each other. Unroll the foil, spreading the charge over more area, and they converge; roll it back, and they separate again. This shows how electric potential diminishes as capacity increases, and the converse.

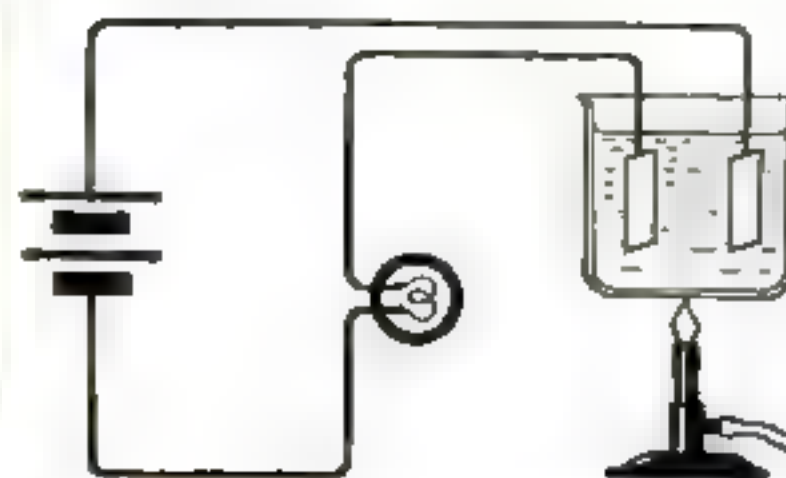


Heating an Electrolyte Lowers Its Resistance



The lamp burns more brightly when the electrolyte is heated

IF YOU heat a wire, its electrical resistance increases, but “electrolytes” or current-carrying liquids behave the opposite way. Connect dry cells, a miniature lamp bulb, and a beakerful of strong salt solution or dilute sulphuric acid in a circuit as shown. The lamp should burn dimly. Heat the solution, and the light brightens, showing that the liquid has less resistance and is letting more current pass.

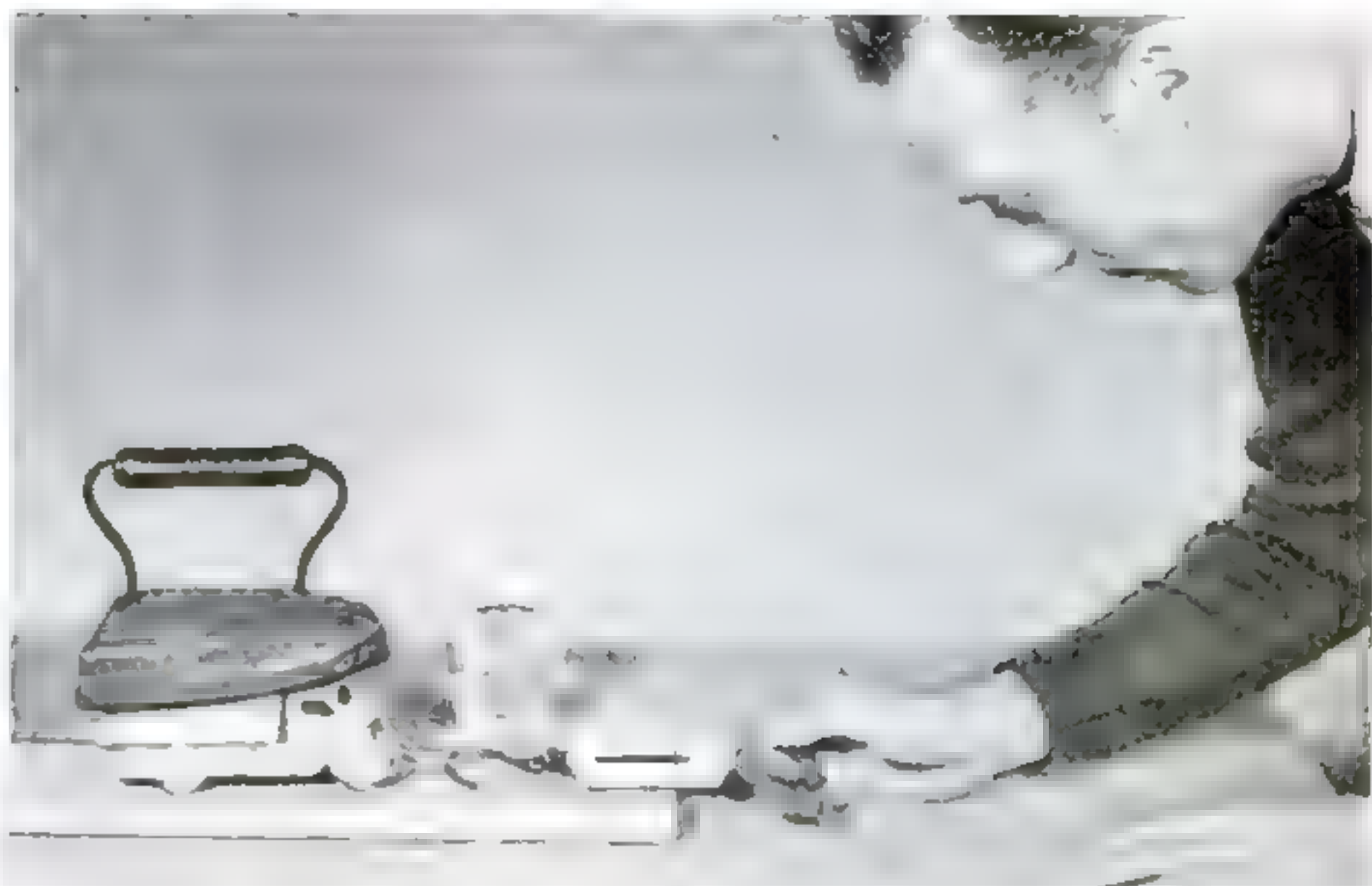


How to connect cells, lamp, and electrolyte solution

Some of Nature's Laws

Toy Car Illustrates Driving Principles

WEIGHTED for better traction, a toy automobile illustrates the performance of full-size cars. Hook a spring balance to the toy and pull it. Readings of the balance show that it takes more power to start a car than to keep it moving. With the wheels locked, draw the car over "roads" of various materials, wet and dry, and you can see the factors involved in "holding the road" or in skidding.



It takes more pull to start the toy car than to keep it in motion

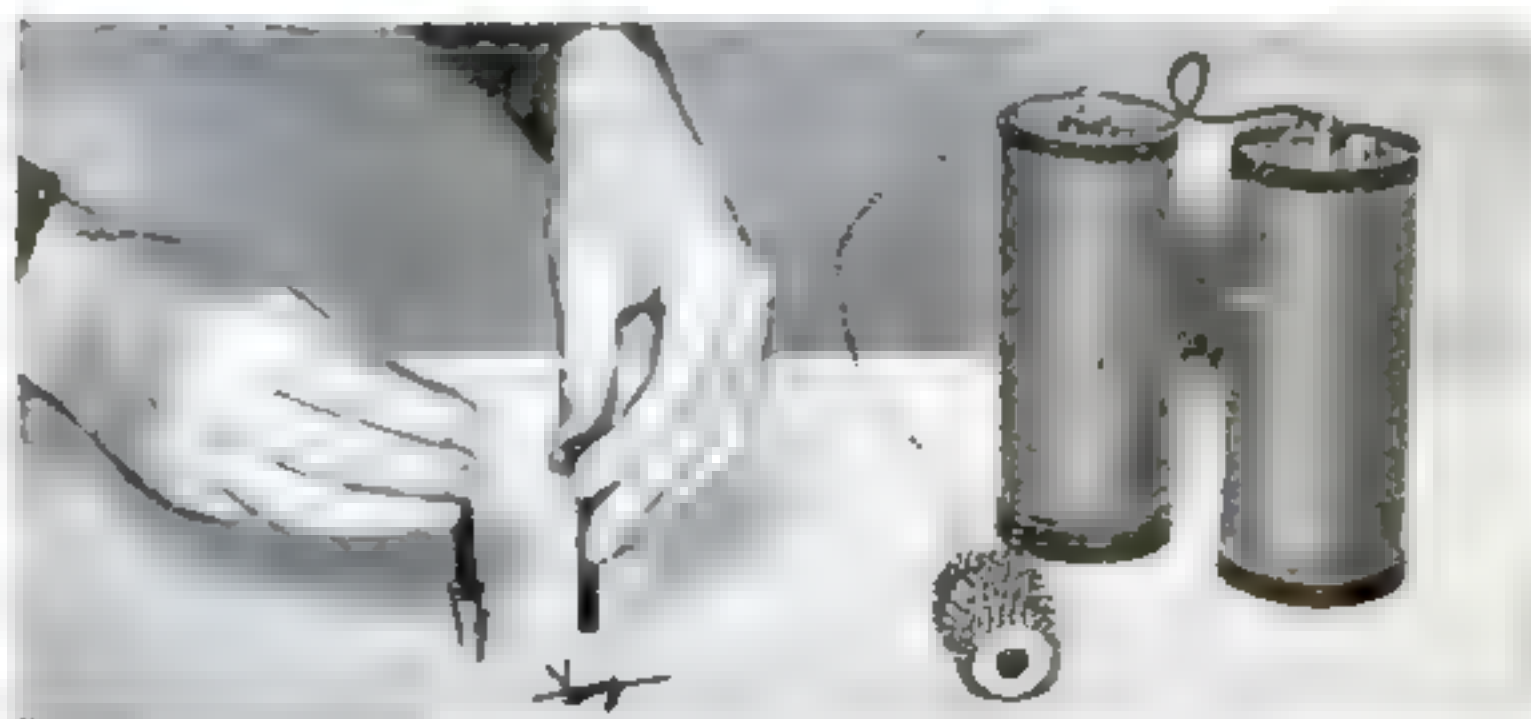
Shaking Mercury Lights Lamp

PLACE several drops of mercury in an olive bottle. Insert the screw portion of a neon lamp in the neck of the bottle and seal with adhesive tape. Shake the bottle in the dark, and the static charge produced will light the lamp. This is a striking stunt to perform as "scientific magic."



Best Metals for Magnets

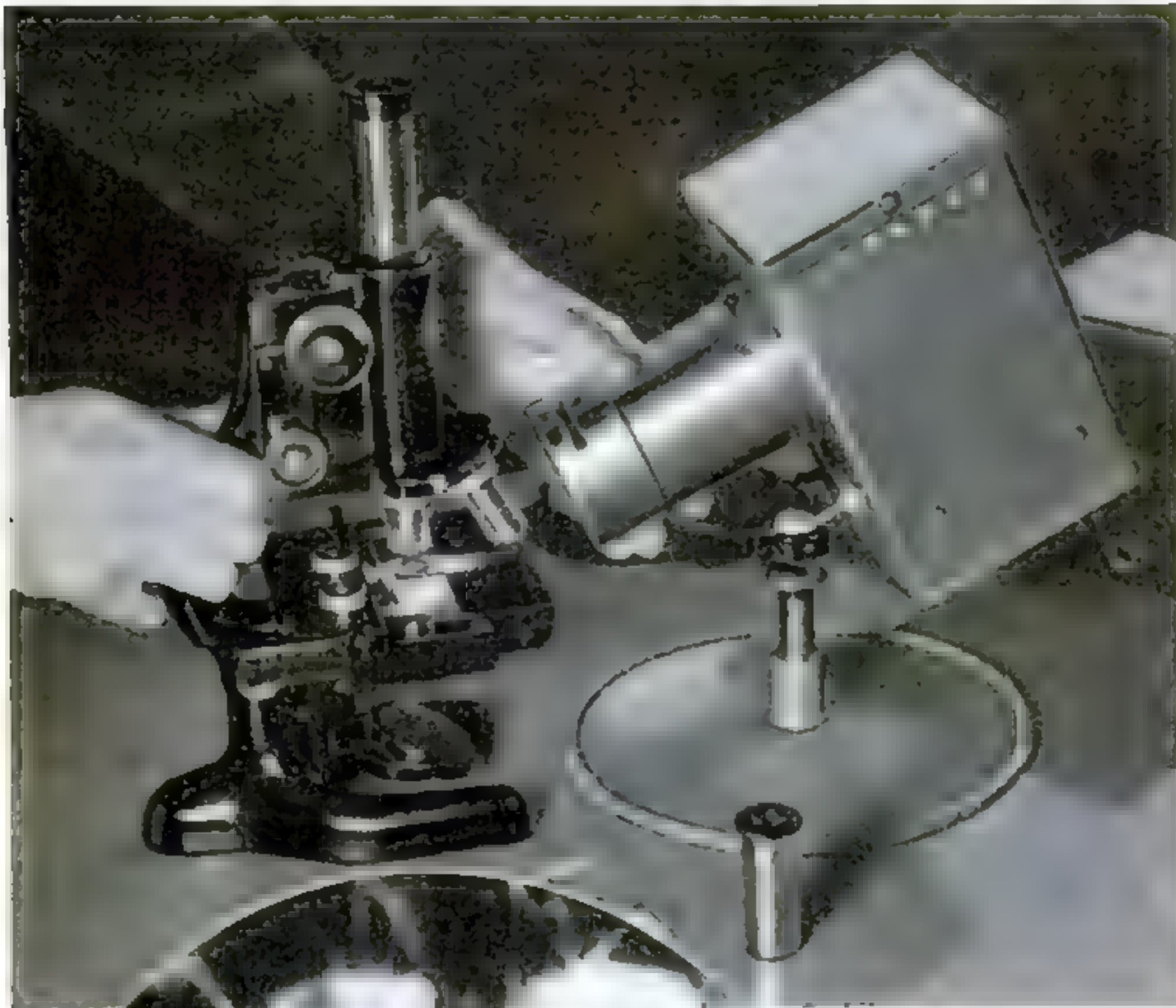
LET a red-hot bolt cool slowly. Plunge another in cold water. The first bolt is better as a magnet, when held in an electric coil; the other, when withdrawn. Electromagnet cores are made of annealed iron, permanent magnets of tempered steel, because easily magnetized substances lose their magnetism easily.



Hearing Through Metal

You can prove that sound waves travel faster through metals than through air, by a simple test. Have a friend tap on an iron fence with a stone or hammer, while you rest one ear against the fence several hundred feet away. You will hear the tap twice—the first sound coming quickly, through the iron, and the second arriving a little later through the air. The farther away you are, the longer will be the interval between the sounds.

Jungles on Stale Bread

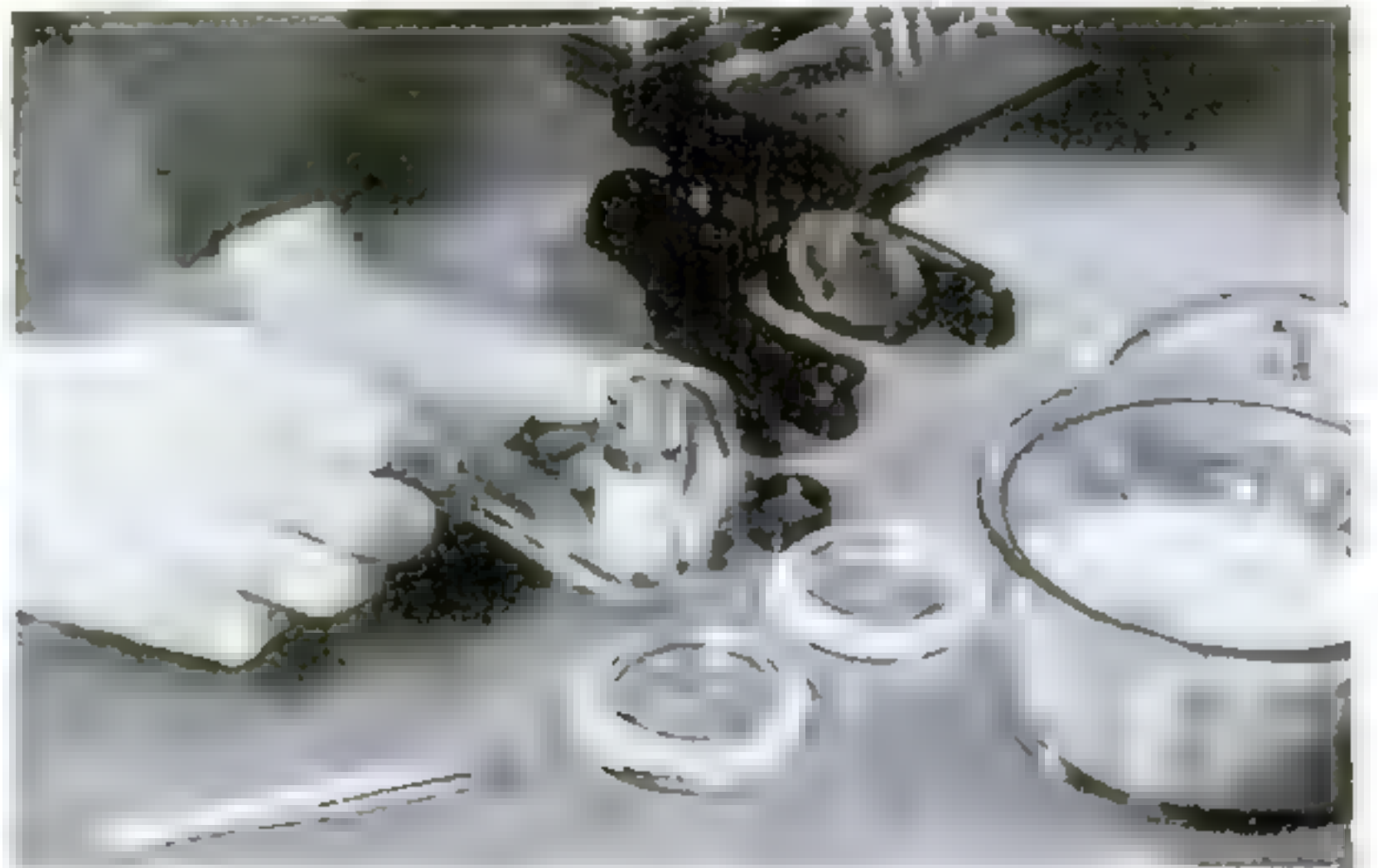


IF YOU are looking for something to investigate with the magic lenses of your microscope, you have only to travel as far as the nearest piece of stale bread. With it, you can unlock the door to the fascinating land of the molds, those primitive plants which, together with their near relatives, comprise about a third of the kingdom of botany.

A botanist thinks of molds as being one of the several classes of thallophytes, which include the various kinds of algæ, and the funguses such as bacteria. The particular kinds of molds you are going to corner with a piece of bread are so common that they can be found almost anywhere. They are the black-headed members of the class of algal funguses, and are known by such names as true molds, black molds, and Mucorales (Zygomycetes).

Directing light on a specimen of bread mold. Left, unripe spore sacs and strands of mycelia revealed by examination in this manner

To obtain an abundant supply of black molds, get a piece of bread, either fresh or stale, and rub it a few times across the carpet, or a linoleum or other floor. Put the piece into a glass dish or jar, or on a plate that can be covered. In the laboratory, a bell jar over a shallow pan or dish usually is employed.



1 Mold grows on stale bread that has been rubbed on the carpet, as on opposite page

2 If permanent mounts are desired, a special dioxan fixative is applied to the mold specimen in a shallow dish

Explored with Your Microscope

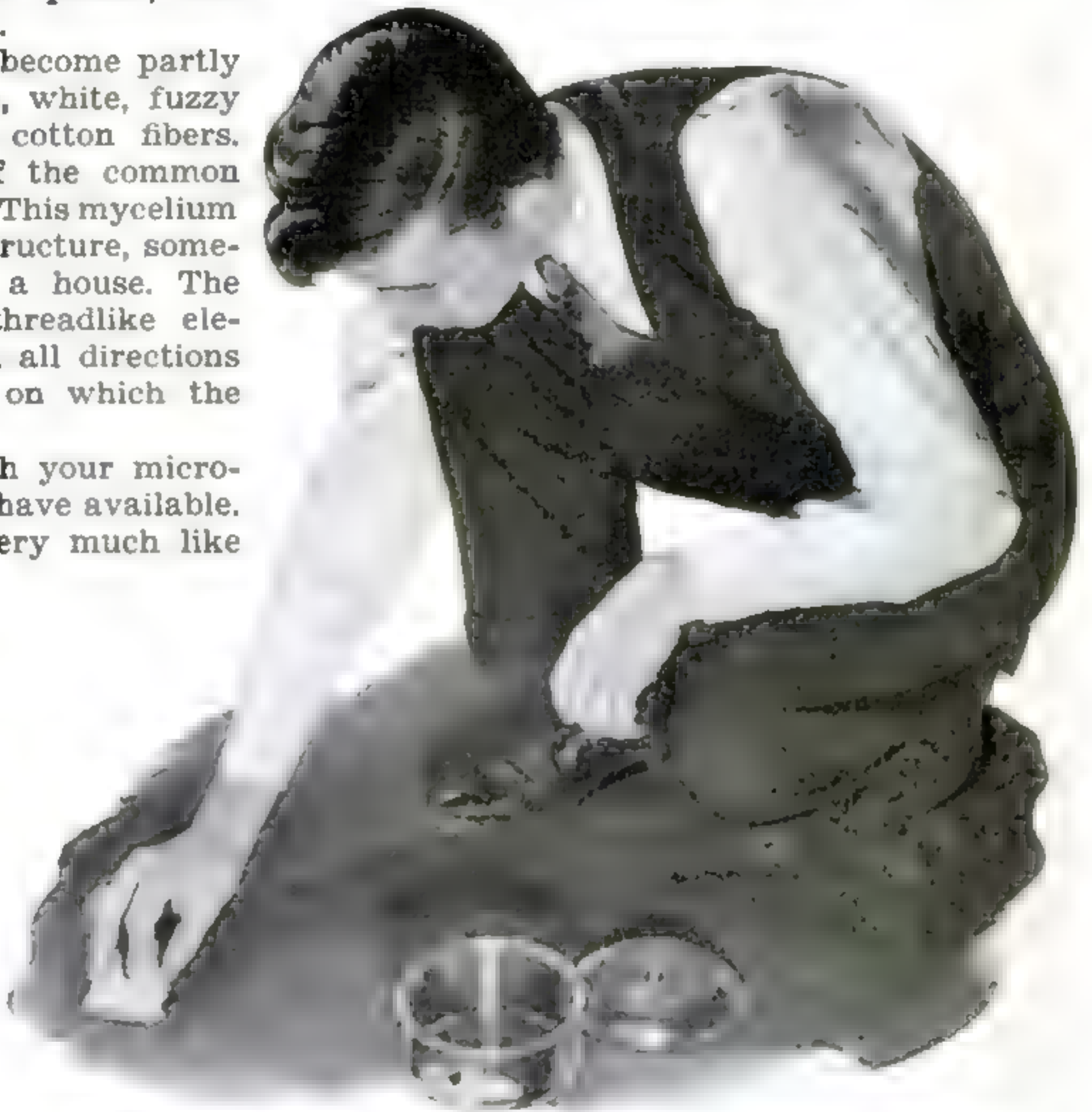
Equally good is a covered refrigerator dish such as that illustrated. Whatever you use, add enough water to moisten the bread thoroughly and keep it moist for several days. Set the dish in a shaded place, and watch the results. Molds do not possess the power to manufacture food with the aid of sunlight, being without the chlorophyll that gives the green color to other plants, and therefore flourish without light.

Before long, the bread will become partly or wholly covered with a fine, white, fuzzy growth that resembles loose cotton fibers. This will be the mycelium of the common bread mold *Rhizopus nigricans*. This mycelium is the main part of the mold structure, something like the foundation of a house. The glistening white hyphæ, or threadlike elements, that form it ramble in all directions over and through the bread on which the mold is flourishing.

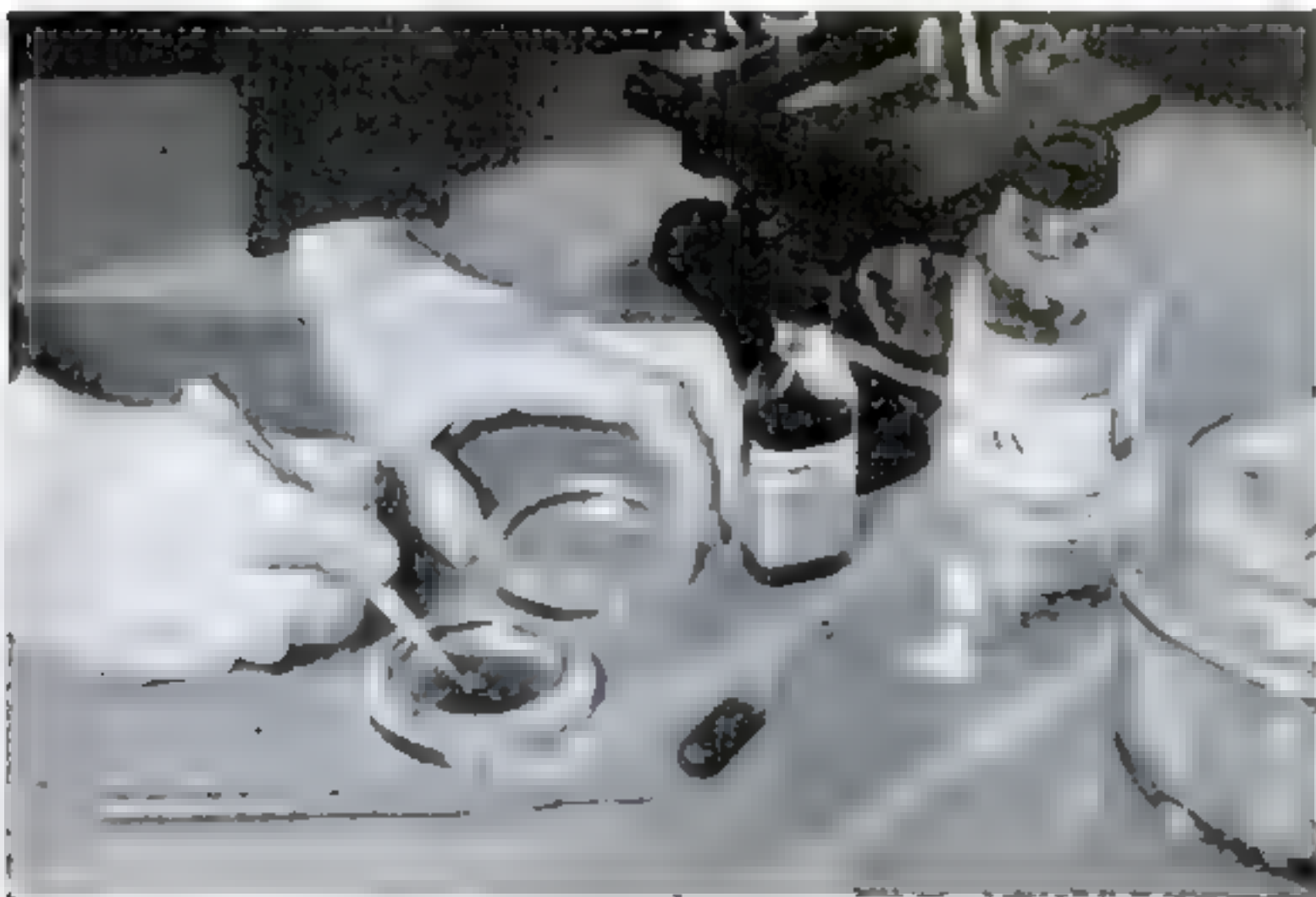
Examine this mycelium with your microscope, using all the power you have available. You will find that it looks very much like some of the filamentous algæ. The long, threadlike cells branch in every direction. Treat the mycelium with some stain such as hæmatoxylin, and you can see the details of its structure better. Note the numerous nuclei in

the cells, and the oily droplets scattered here and there.

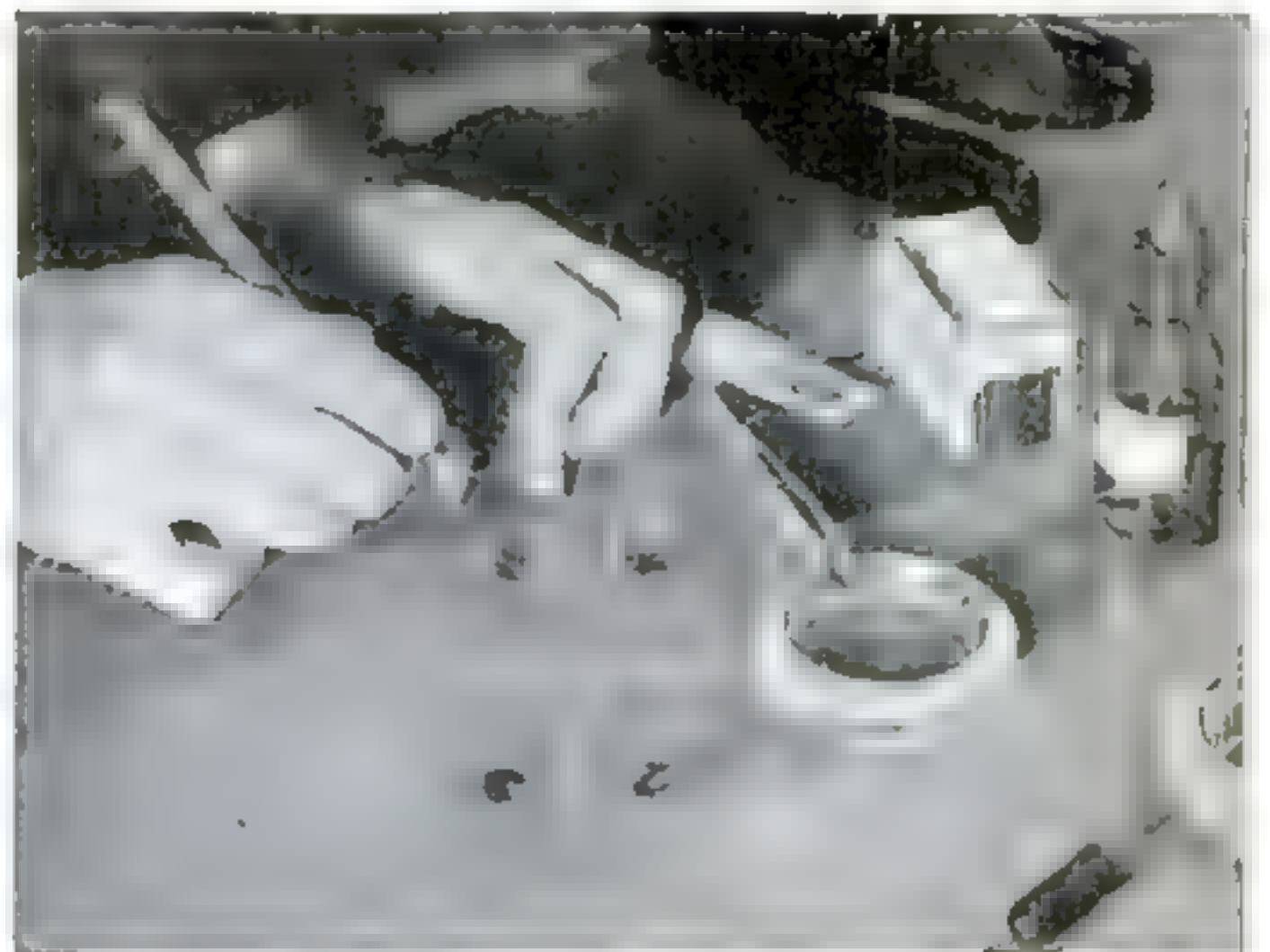
Before the mold has grown very much, you will discover, among the hyphæ, little bulbous structures at the ends of short stalks or stems. They look quite a bit like the heads of matches. Keep an eye on these, and you will see them develop, almost in a matter of



By
**MORTON C.
WALLING**



3 Staining will bring out details. Here the specimen is being placed in the staining solution



4 The final step is to place the specimen in a drop of dioxan-thinned balsam on a slide

hours, into round, white balls that can be distinguished with the naked eye. These are beautiful by dark-field or reflected illumination: if you have no dark-field condenser or wheel stop, set your microscope so the sun or other bright light falls on the stage, and place some of the mold growth on a slide, with or without a cover glass.

THESE balls are the sporangia or spore-forming bodies. The bread mold and its relatives reproduce largely by asexual spores, which act very much like seeds but are merely specialized cells capable of growing into new plants. Less common is a sexual method in which two branches grow outward from adjacent hyphae and unite to form a zygospore. These dark thick-walled spores sometimes can be seen between the swollen, empty-looking tips of the branches in a mass of bread-mold filaments. Only moderate magnification is necessary to reveal them. The zygospores seem to be more durable than the simple and more common asexual spores. They later germinate to form a new mold plant.

Coming back to the white, glistening spheres you first discovered, you will note that they do not remain white long, but darken and eventually become black. This gives the black molds their name. Under the microscope, the surface of one of these balls (sporangia) looks pebbled, an effect produced by the numerous, rounded spores, which are packed tightly inside the inclosing membrane. When the spores are ripe, they break from the sporangia and are scattered about by the wind, to find new growing places. They lurk everywhere by the billions. That is why you always can

pick up some with a piece of bread by rubbing it on the floor. In fact, it usually is easy to start a growth simply by moistening the bread, without giving it the floor treatment. After the spores have gone, the empty spore cases look somewhat like microscopic toadstools (P.S.M., Jan. '39, p. 201).

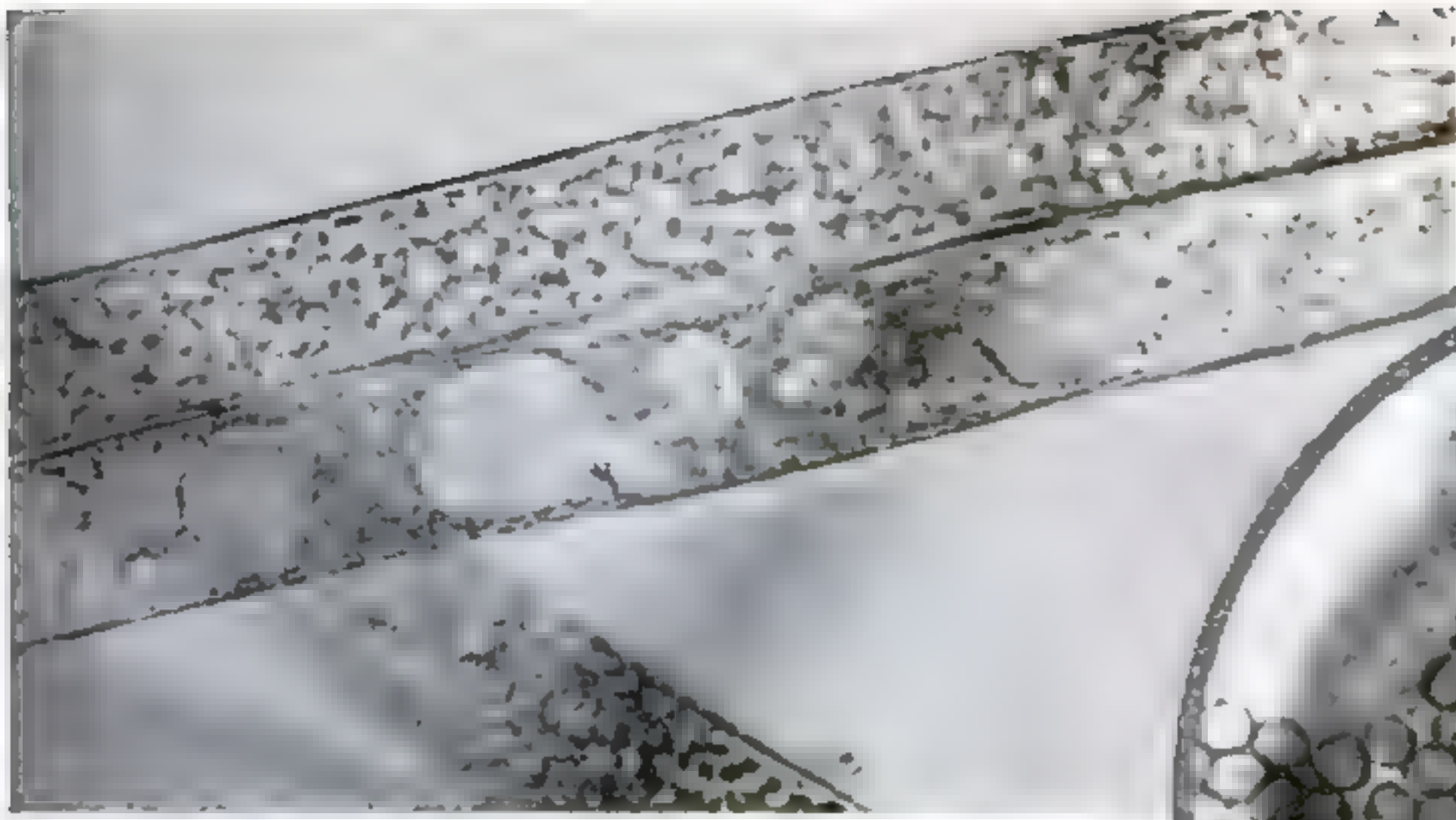
Nearest relatives of the bread mold include forms that flourish on preserves, jelly, and canned foods. The next time some one opens a jar or glass of such food in your home, and discovers mold, collect the growth in a petri dish or watch glass, and examine it with your microscope. It is interesting to compare it with the bread mold and with other forms you have studied.

One of the most interesting relatives of the bread mold is *Empusa muscae*. Its specialties are killing house flies and imitating artillery. You probably have discovered, on window panes and elsewhere, dead flies that were covered by a white, powdery growth that extended outward to form a circle some distance from the fly's body. This fungus, which for some reason or other prefers to grow in the body of a fly, has the remarkable ability to shoot its sporangia through the air like tiny cannon balls. The spores are

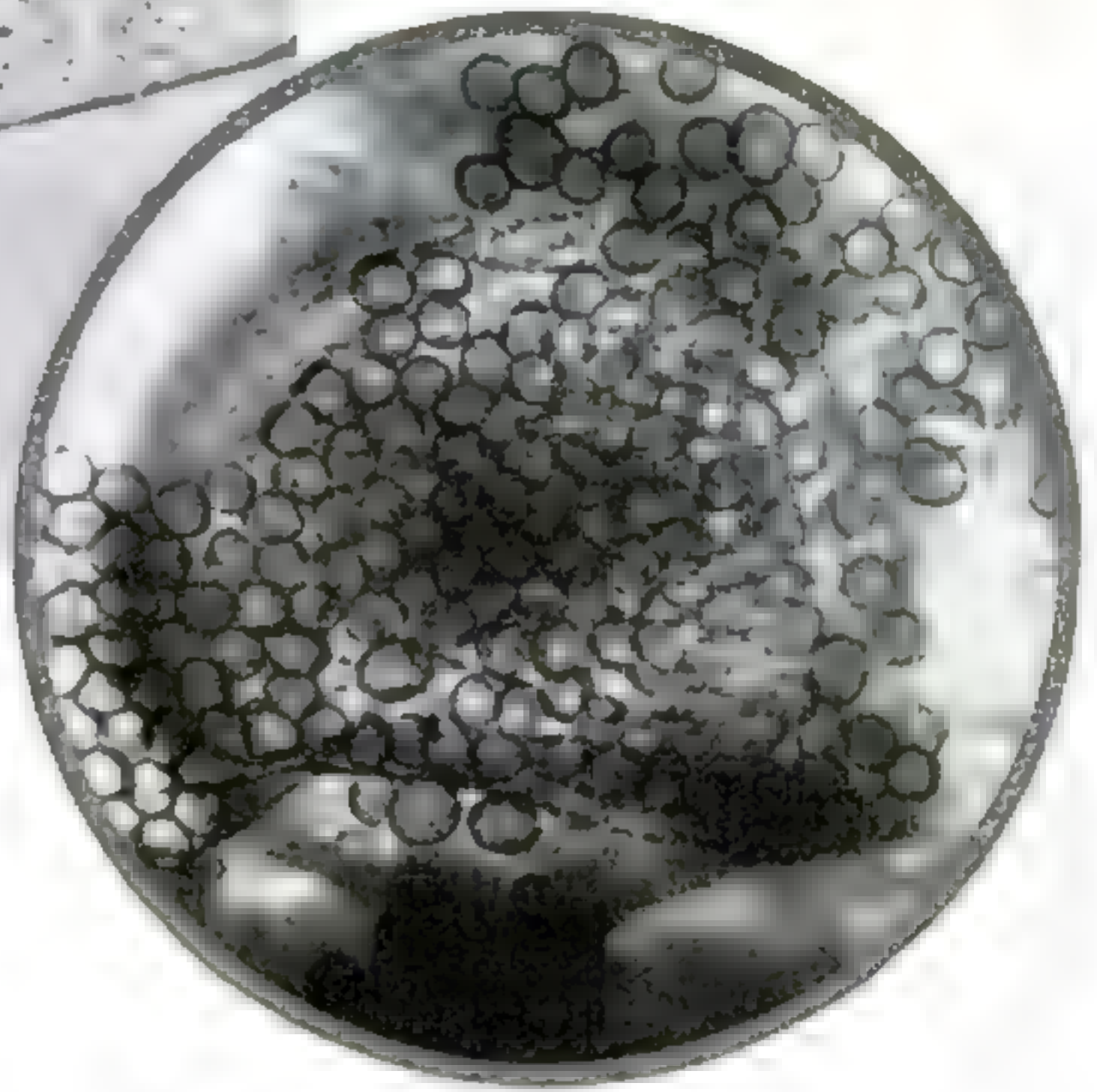


CHECKING UP ON MOLD IN FOOD PRODUCTS

This expert of the U.S. Department of Agriculture is studying mold on food samples as part of the job of safeguarding the nation's health. The photomicrograph shows bread mold as it appears by transmitted light. The sporangia are ripe, one discharging spores



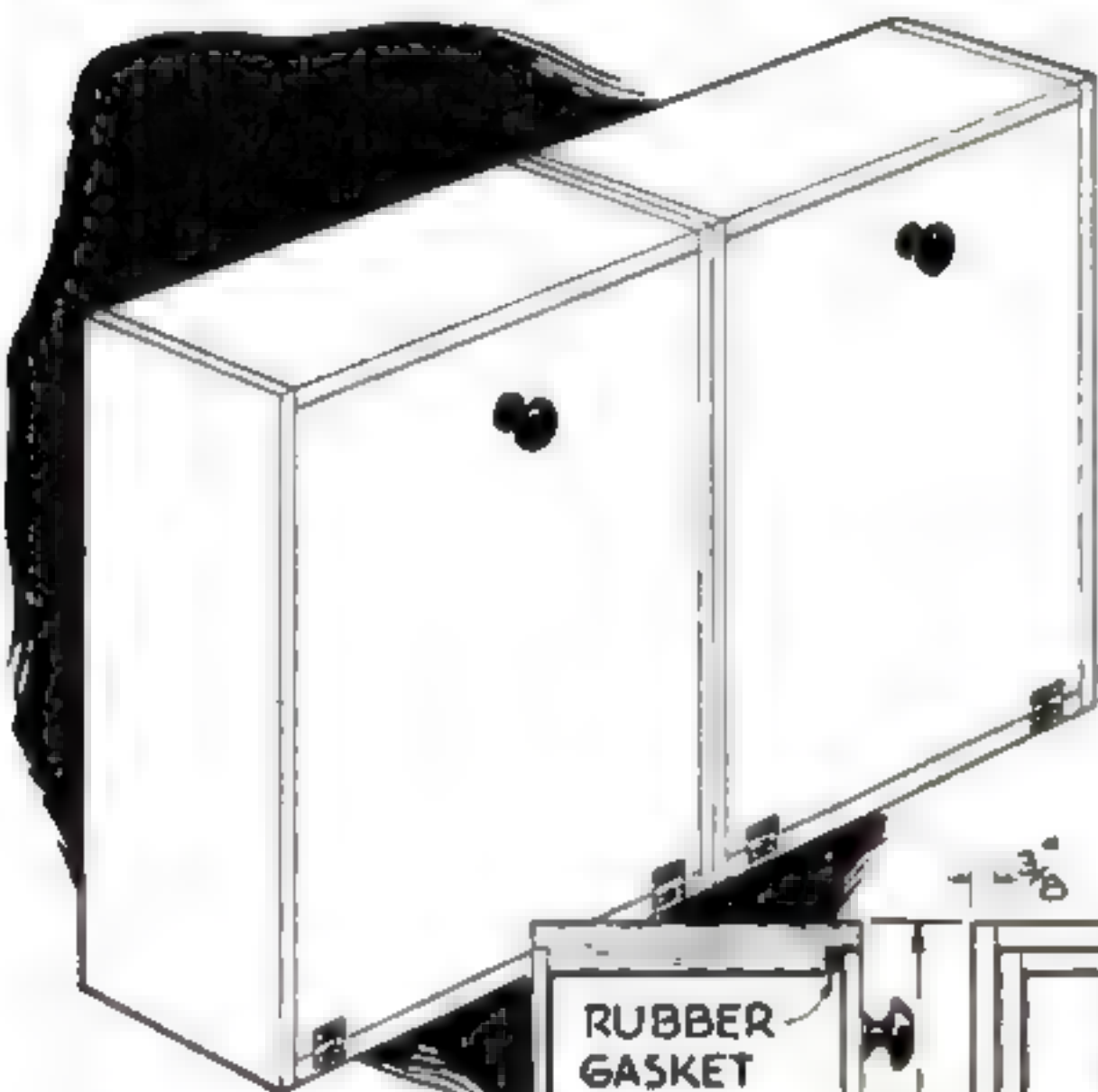
Left, highly magnified view of mycelium filaments, with cell contents visible. Below, spores leaving sporangium, magnified 2,000 diameters



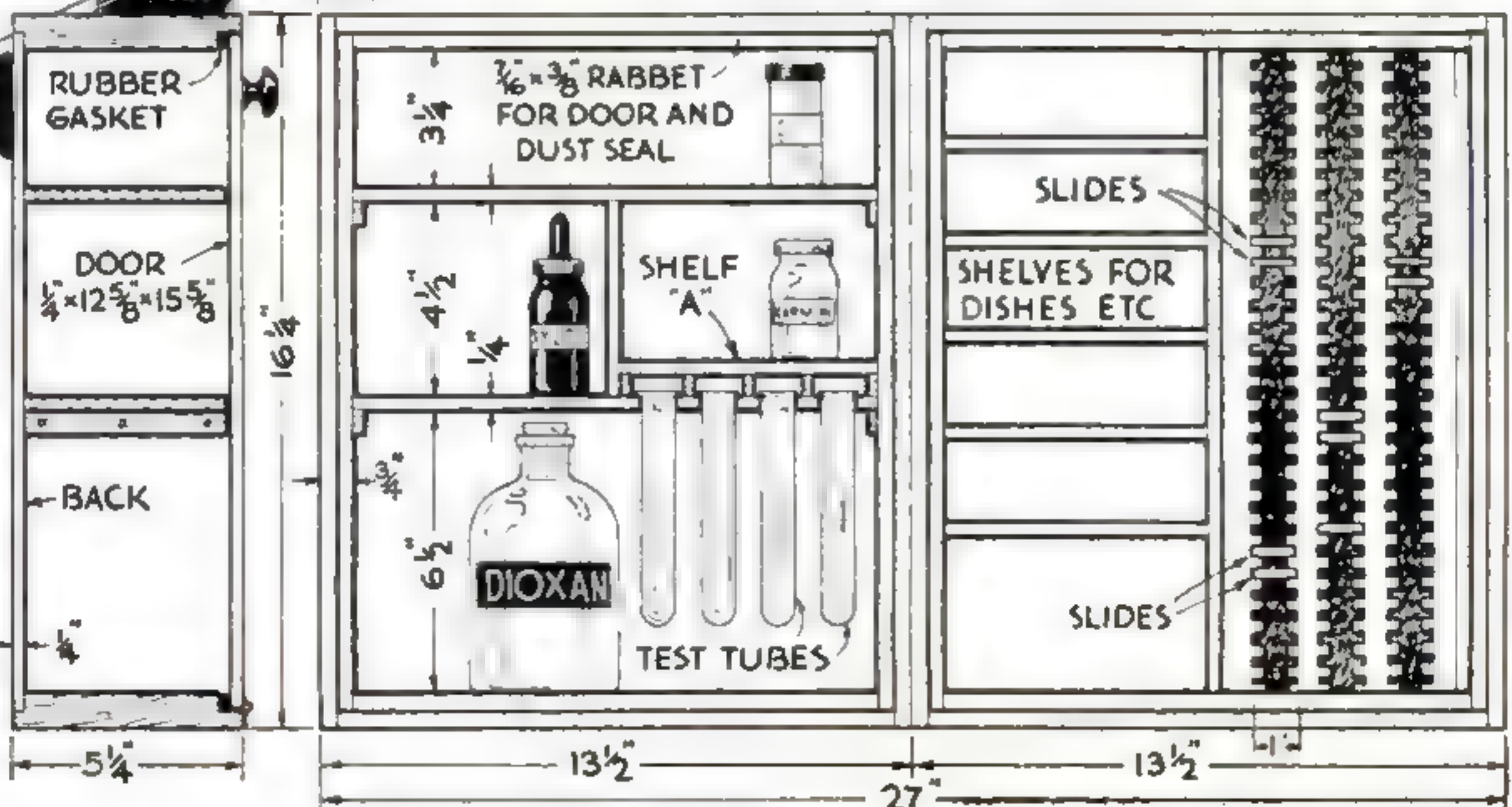
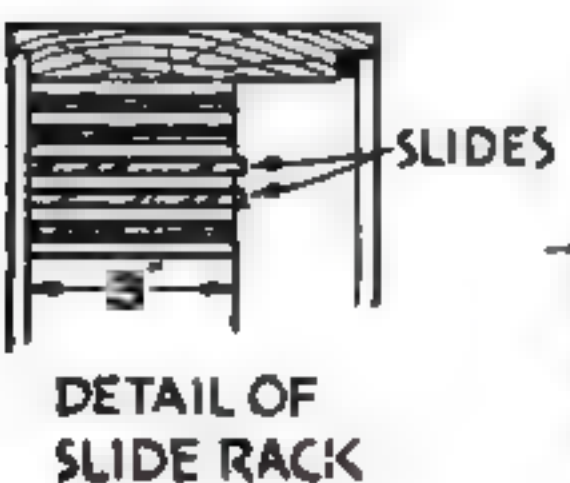
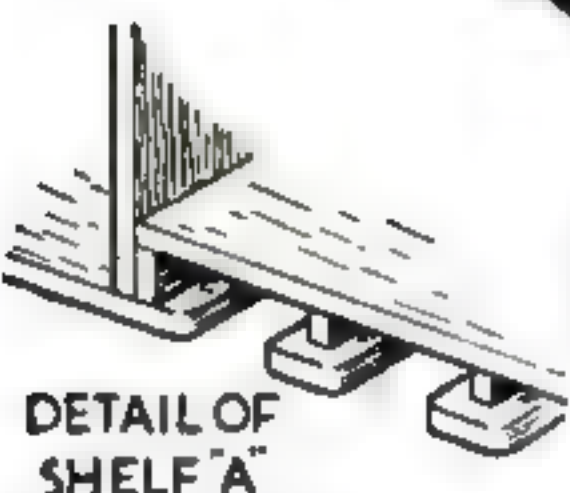
thus deprived of any excuse for hanging around the parent plant instead of going out into the world to found new mycelia of their own. The white halo often seen around the body of a dead fly is the result of this shooting ability.

The microscopic study of funguses is a highly important activity of science. Even in other fields, *(Continued on page 220)*

HANDY UNIT CABINETS FOR YOUR MICROSCOPE LABORATORY



FOR storing your growing collection of microscope accessories and supplies, you will find it worth while to build a series of unit cabinets like those illustrated, which can be adapted to your needs and to the space available. Various shelf arrangements are indicated, to accommodate objects of different shapes and sizes. Material need not be expensive; packing-box wood will do. Tight, dustproof construction is desirable throughout and the cabinets should be painted inside, preferable in a light shade of buff or green. The outside may be finished to harmonize with the room. The drawings give construction details.

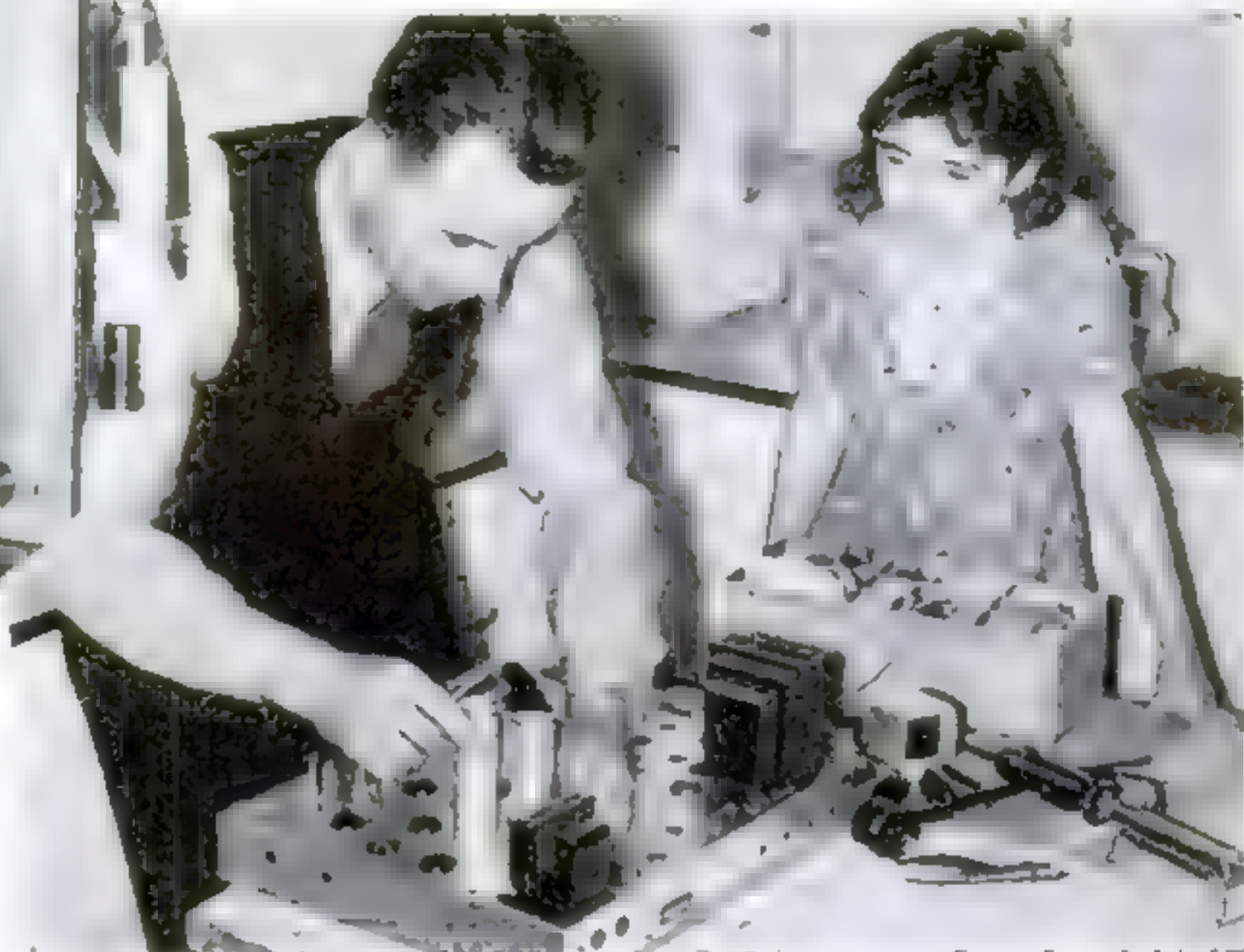


New Radio Aids for

Television Receiving Sets Now Come in Kit Form



SET builders who enjoy constructing their radio equipment can now assemble their own television receivers from the parts contained in compact kits recently placed on the market. Offered by a number of different manufacturers, the television kits, in most cases, contain all the parts needed with the exception of the tubes. A panel with necessary holes conveniently drilled, a chassis, and complete step-by-step instructions together with nontechnical wiring diagrams designed to be

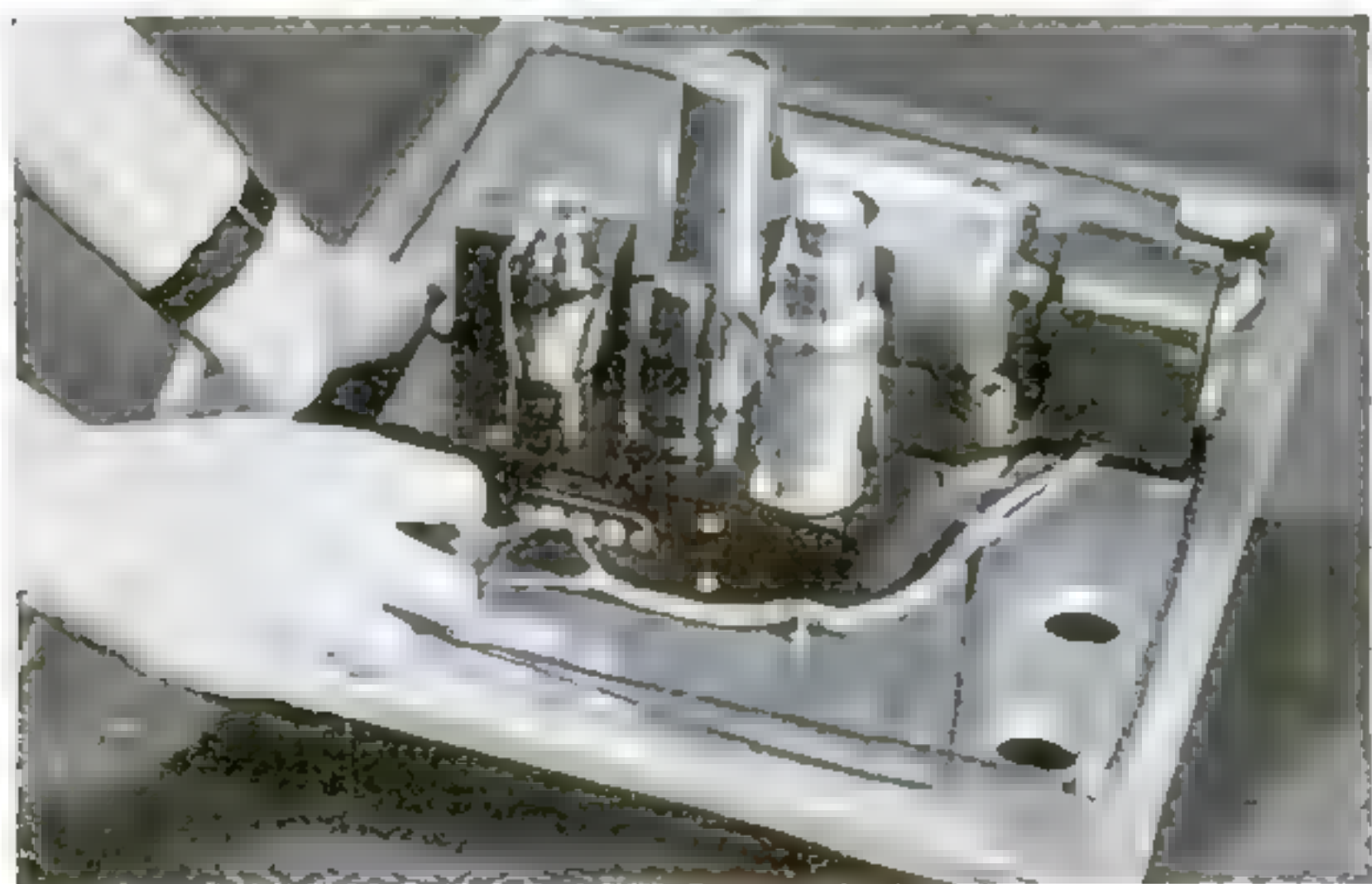


Anyone handy with tools can assemble this television receiver supplied in kit form. The finished unit is shown at the left

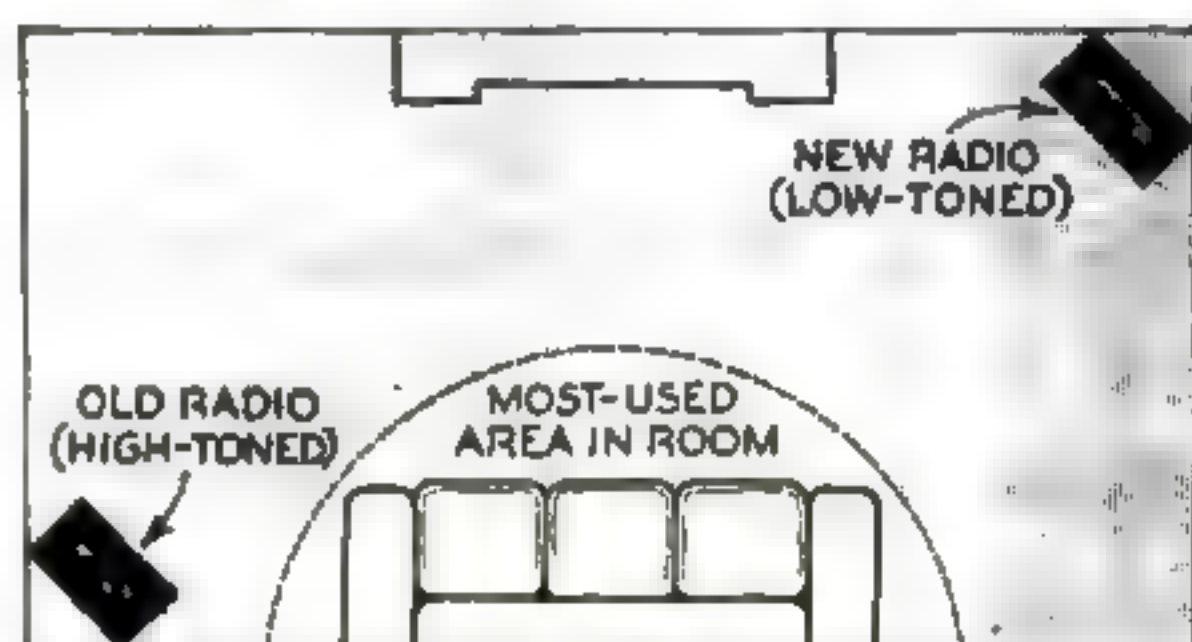
easy to understand and follow are also provided. The kit illustrated above, according to the maker, can be assembled by anyone handy with tools in less than thirty-hours.

New Record-Player Accessory

EMPLOYING three tubes instead of the usual two in order to provide separate oscillator and mixer tubes, a new type of "wireless" radio-phonograph accessory for eliminating connections between the phonograph and the radio receiver is said to be distortion-free even on the loudest passages. The unit, small enough to be mounted under the turntable panel, may be used with any electric phonograph.



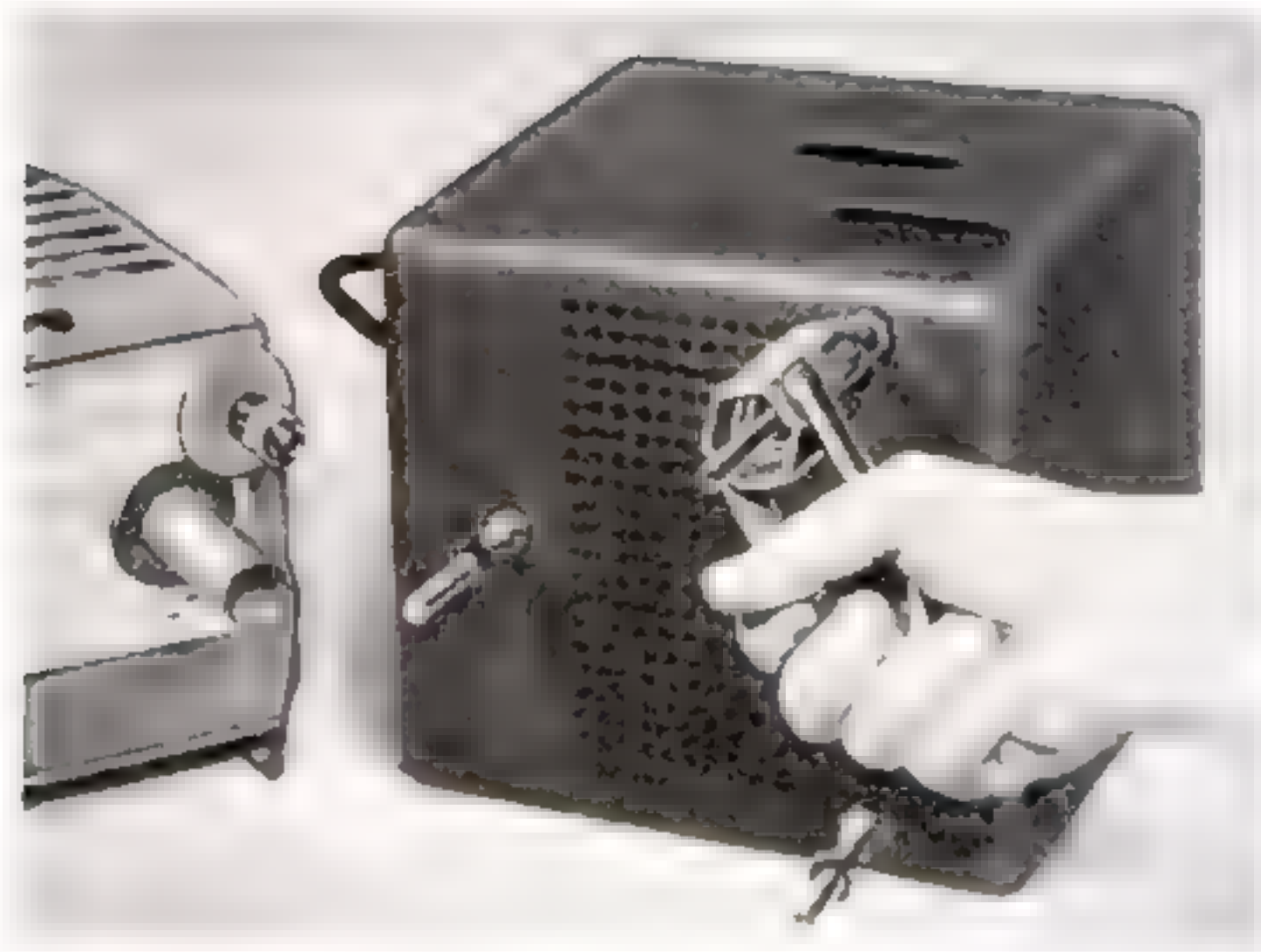
How the radio-phonograph accessory fits under the turntable



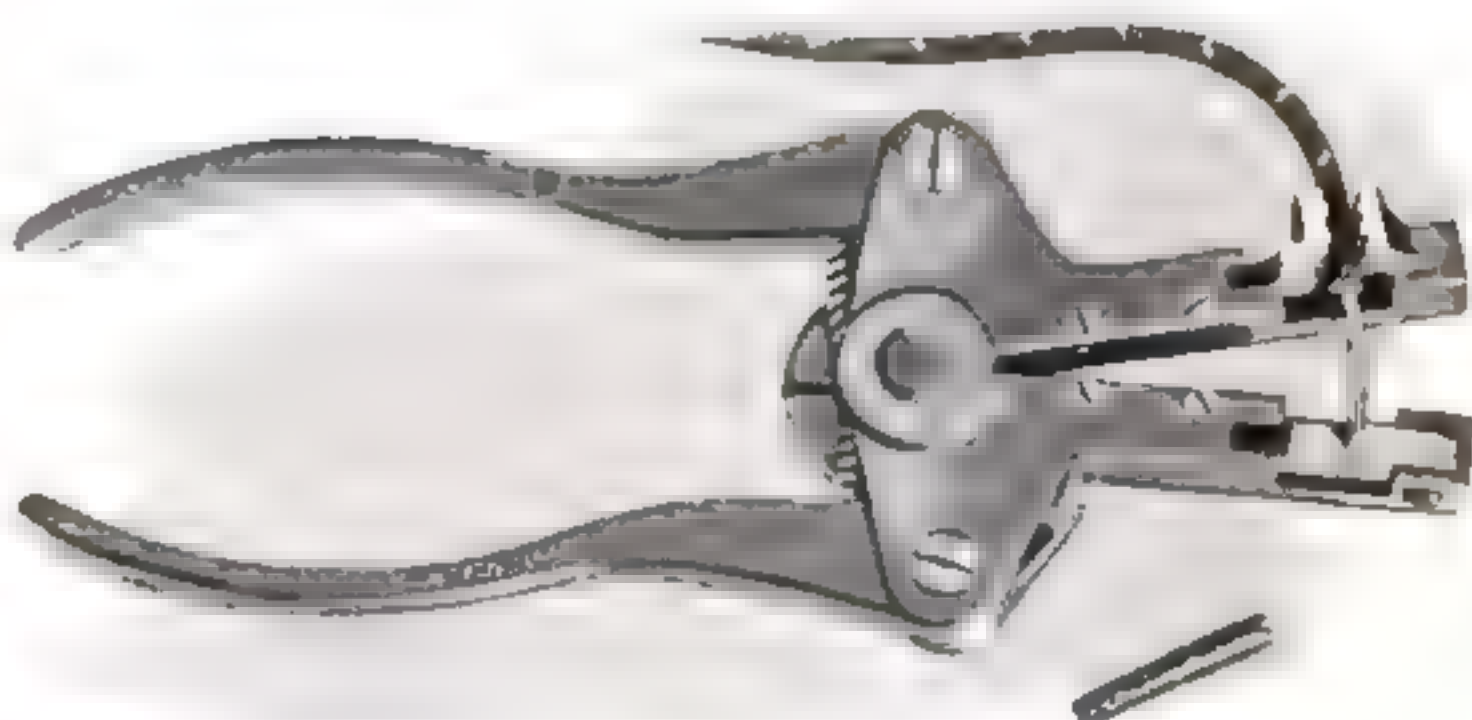
"Stereophonic" Effect from Two Receivers

DON'T throw away your old radio when you invest in a new one, advises Prof. Max F. Meyer, of the University of Miami, Florida. Place the sets in diagonally opposite corners of a room, turn the tone control of one set to concentrate on the high-pitched notes, and adjust the other to let through the low tones. Then tune both to the same program and the result will be "stereophonic" reception, in which an orchestra or singers seem to be in the same room with the listener. The effect is said to be realistic.

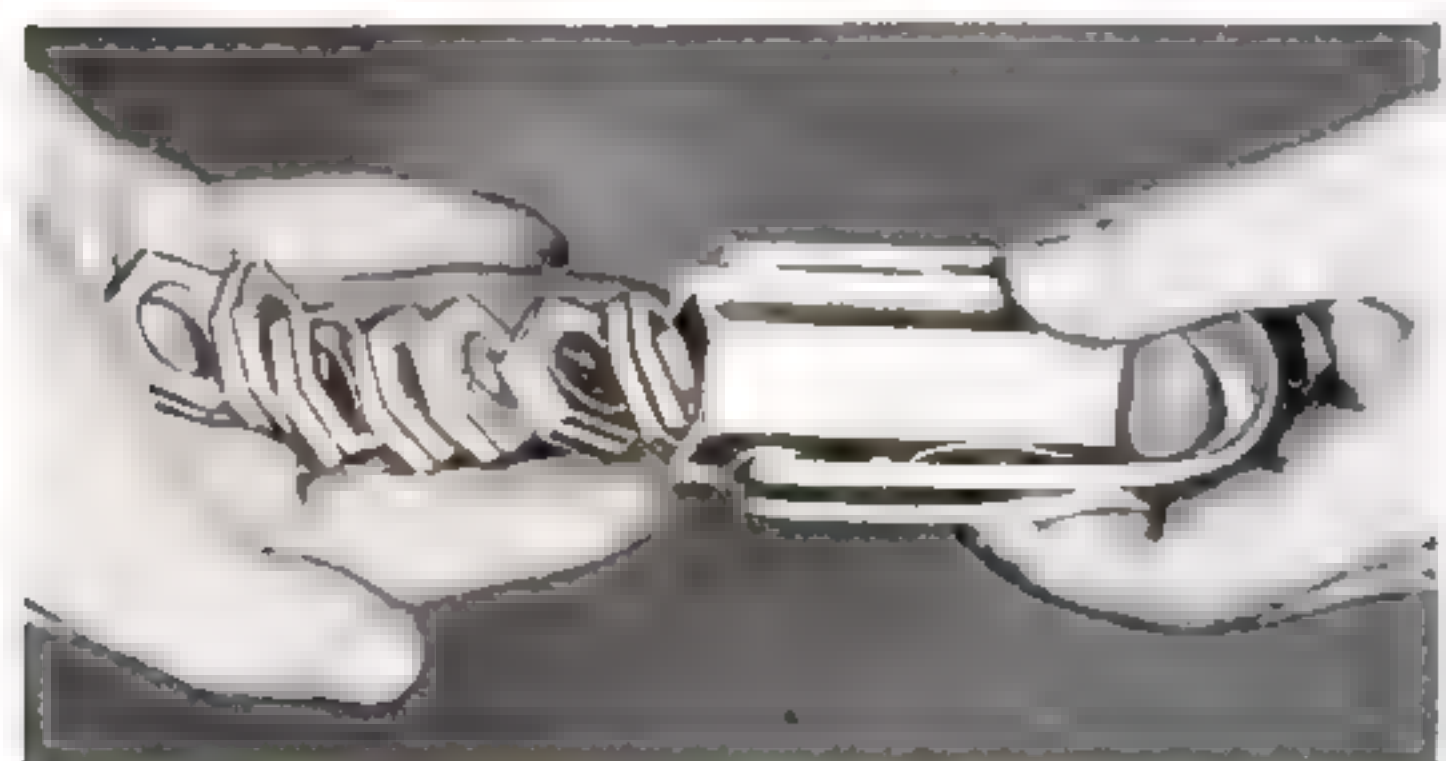
Amateur Set Builders



Low-Cost Wire Stripper Saves Time and Trouble



QUICKLY stripping the insulation from either solid or stranded wire of various sizes, a handy new tool should prove a time and labor-saving device for the amateur radio fan. When wire is placed in the jaws of the unit, a squeeze of the handle is all that is required to strip off the insulation, leaving bare wire. Inexpensive, the sturdy tool, shown in the illustration above, should prove popular with home electricians and mechanics as well as with radio men.



Seven Socket Wrenches Combined in One Tool

SOCKET WRENCHES in seven different sizes are conveniently stored within the handle of a handy new radio tool. When a wrench of the desired dimensions is placed in the hollow tool head, a twist of the head collar locks it in place, and it is then ready for tightening or loosening a nut by means of the hinged handle, as shown in the top photograph above. Extra-long bolts extend through the tool, permitting nut run-ups regardless of the length of the bolt.

New Automobile Antenna Fits on Edge of Door

NO HOLES need to be drilled into an automobile body to mount a new telescoping cowl antenna for car radios. Fitting any standard-model car, the rod antenna is supported by specially designed flat brackets which are clamped to the leading edge of the car door, while the latter is held in open position. The brackets do not interfere with the operation of the door. A spring prevents the antenna from rattling when telescoped, and provides a positive lead-in contact at all times.



Flat brackets are clamped to the edge of the door

Tiny Portable



The set, complete with batteries, is little larger than a dollar box camera

POWERED by its own built-in battery supply, this compact portable receiver is a handy companion for use on picnics, at summer camps, on your garden terrace, or anywhere that a 110-volt house-lighting circuit is not available. Complete with loud-speaker, it weighs but a few pounds and is little larger than the average dollar box camera.

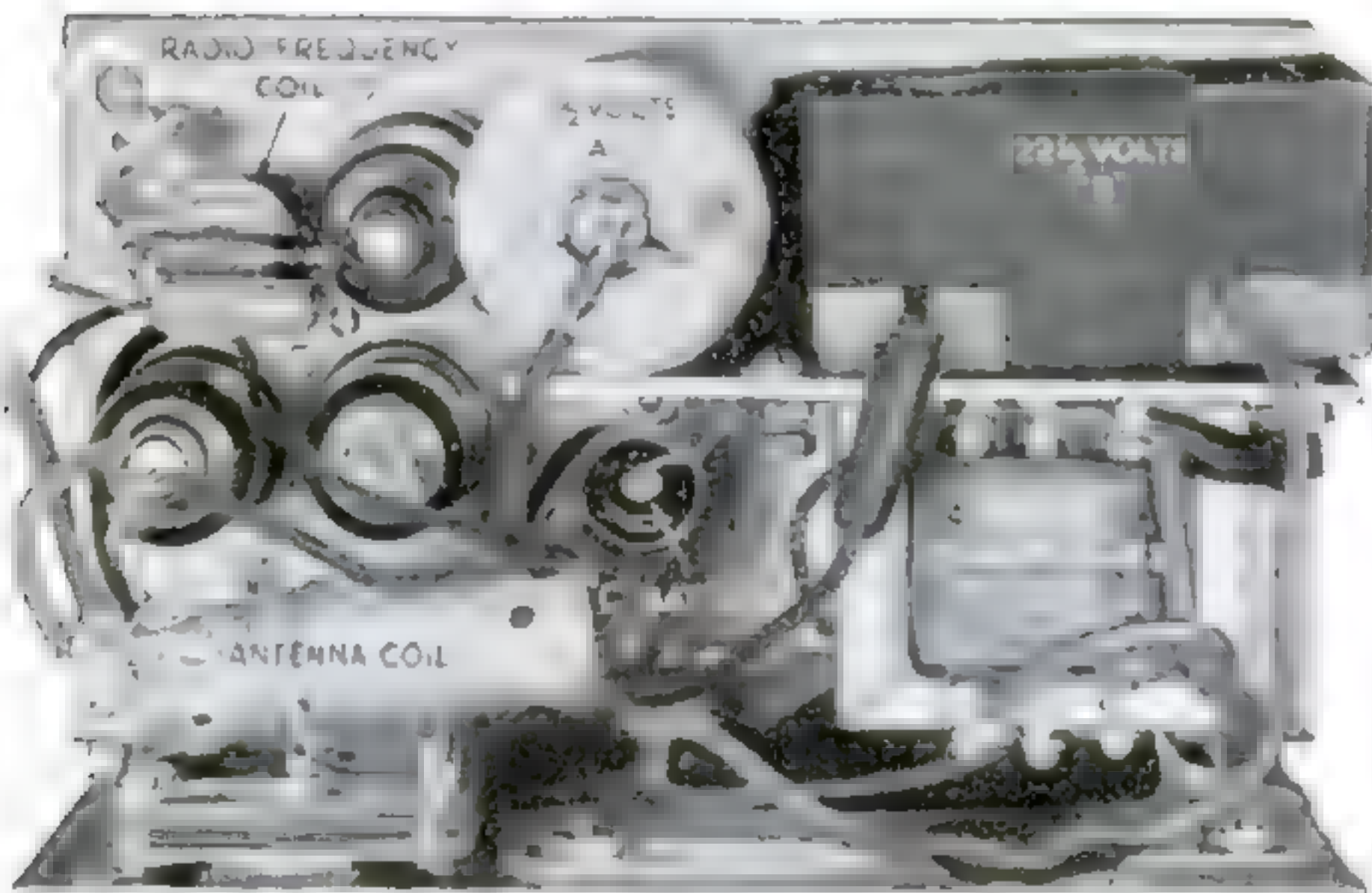
To cram as much radio into as little space as possible, the tuned radio-frequency circuit was designed around three of the newest $1\frac{1}{2}$ -volt midget tubes. Operating on plate voltages from

50 to 60 volts and having an extremely low current drain, the midget tubes make it possible to cut the battery supply to the minimum. Although the tubes are manufactured in England, they are available in the United States and can be obtained from any of the larger radio-parts supply houses.

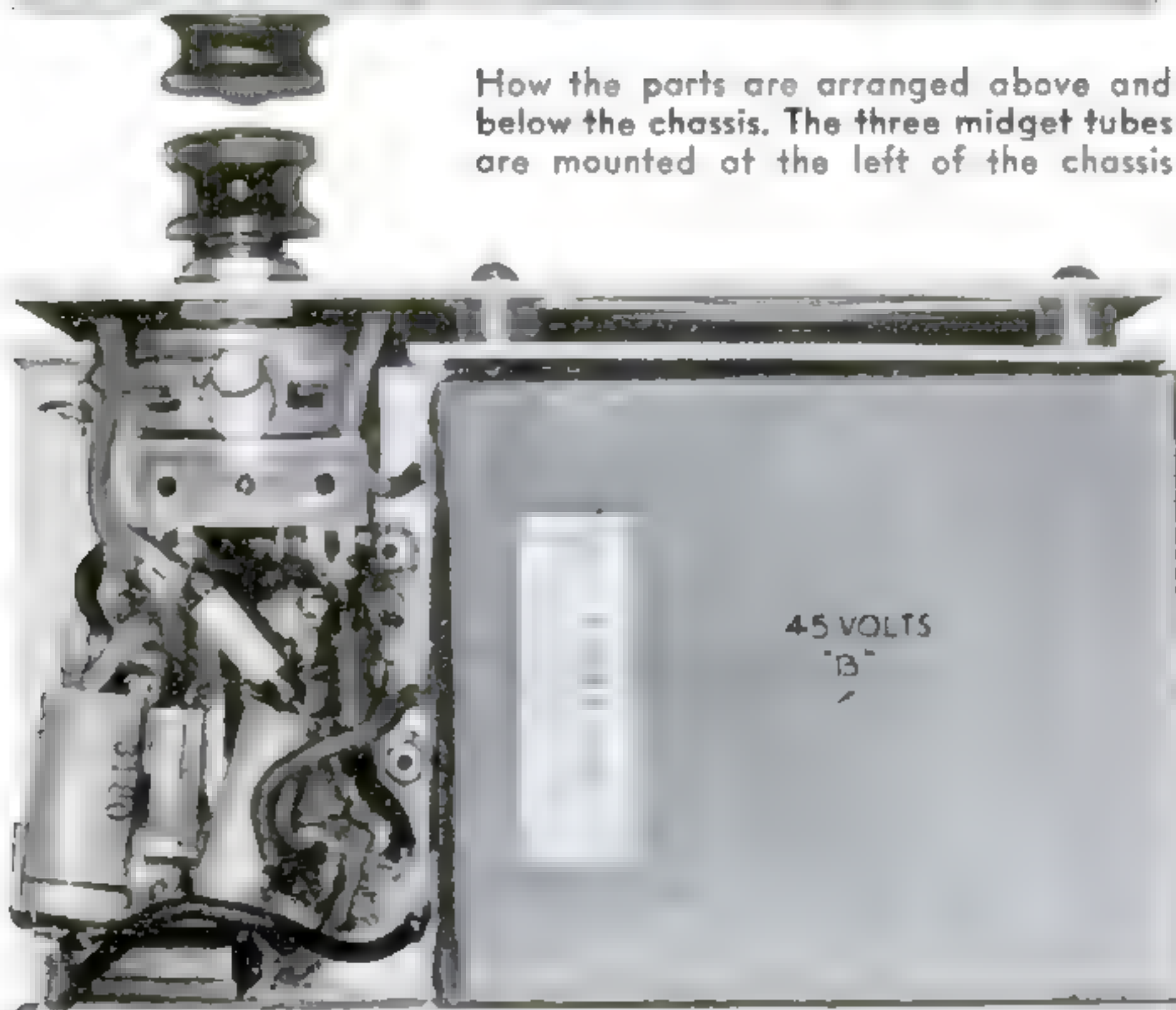
All three tubes are of the pentode type and must be used with the special midget sockets designed for them. As shown in the diagram, the third grids, or suppressors, of the radio-frequency pentode and detector are brought out to pins in the bases of the tubes (pin No. 3) and should be connected to the minus lead of the "A" battery or to the aluminum chassis. The suppressor grid of the output tube (XY) is connected internally so that no external connection is required.

The antenna and radio-frequency coils are of the standard broadcast type used in commercial A.C.-D.C. receivers. As sold, they are mounted in square aluminum cans. Because of the limited space, these shields must be removed. As shown in the photographs, the radio-frequency coil is mounted vertically at the rear of the chassis, and the antenna coil is placed directly behind the antenna tuning condenser.

To conserve space, variable condensers of the "solid-dielectric" type are used for tuning the antenna and radio-frequency coils. These condensers, unlike



How the parts are arranged above and below the chassis. The three midget tubes are mounted at the left of the chassis



Radio Operates Anywhere

By

ARTHUR C. MILLER

the air-spaced variety, depend on thin sheets of insulating material instead of air for insulation between adjacent plates. The result is a wafer-thin unit that can be installed easily in the space available. However, since this type of condenser cannot be ganged, they must be tuned separately. For this reason, they should be mounted one above the other on the $2\frac{5}{8}$ " by $5\frac{1}{4}$ " by $5\frac{1}{2}$ " aluminum panel (B), which also serves as a mounting for the 3" permanent-magnet loudspeaker.

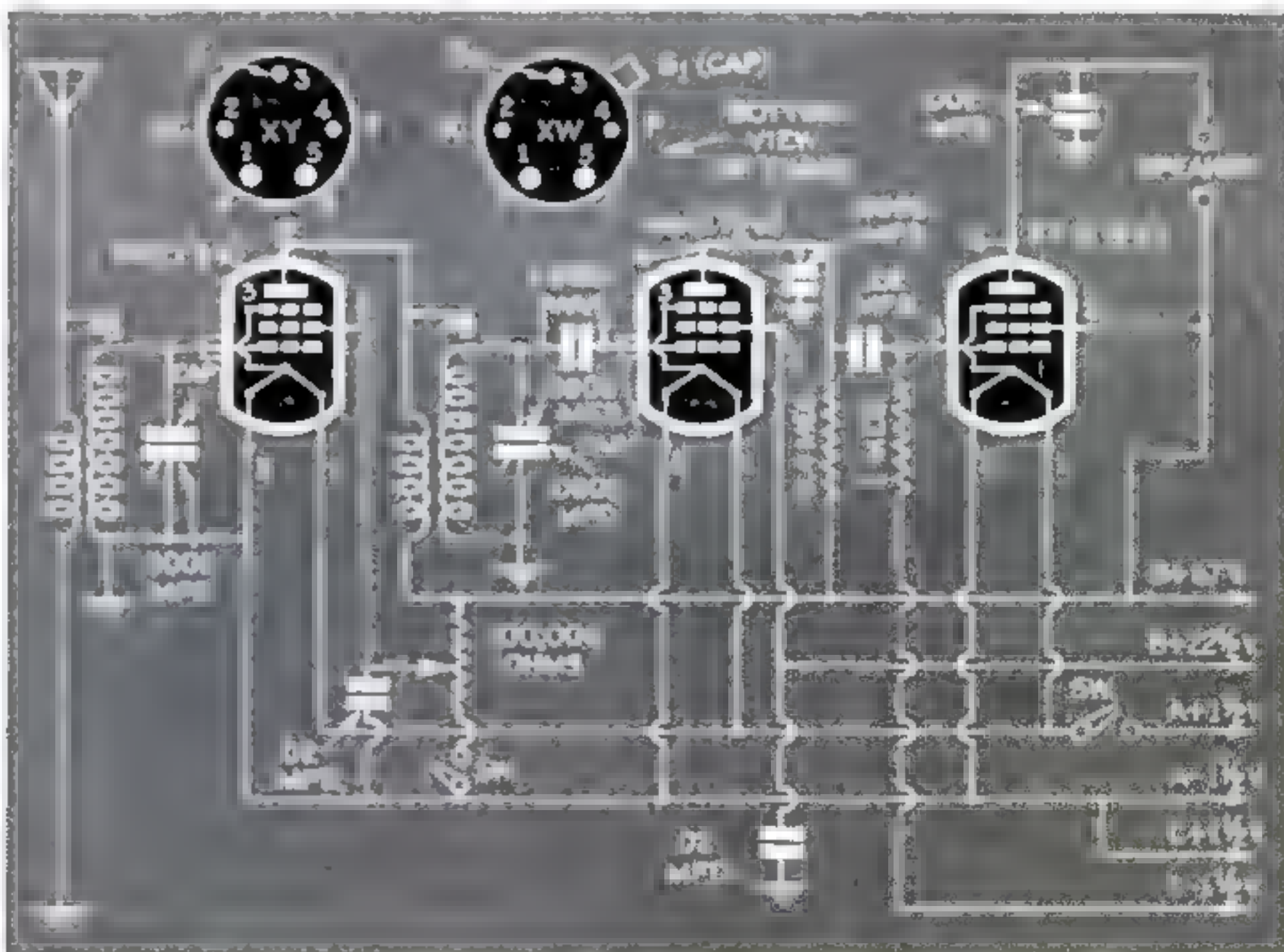
Because of the compactness of the loudspeaker, the output transformer is not mounted on the speaker framework, and must be mounted separately. For this, a $3\frac{1}{4}$ " by $3\frac{1}{4}$ " auxiliary panel (C) must be made. As shown in the photographs, this is placed behind the speaker and also serves as a support for two of the midget batteries.

To provide space for the lower part of the speaker framework, the main front panel is fastened to the chassis by means of $3/16$ " long brass bushings. Also, notice that the front of the chassis at the left side is cut away to provide clearance for the potentiometer and double-pole, single-throw switch mounted on the front panel.

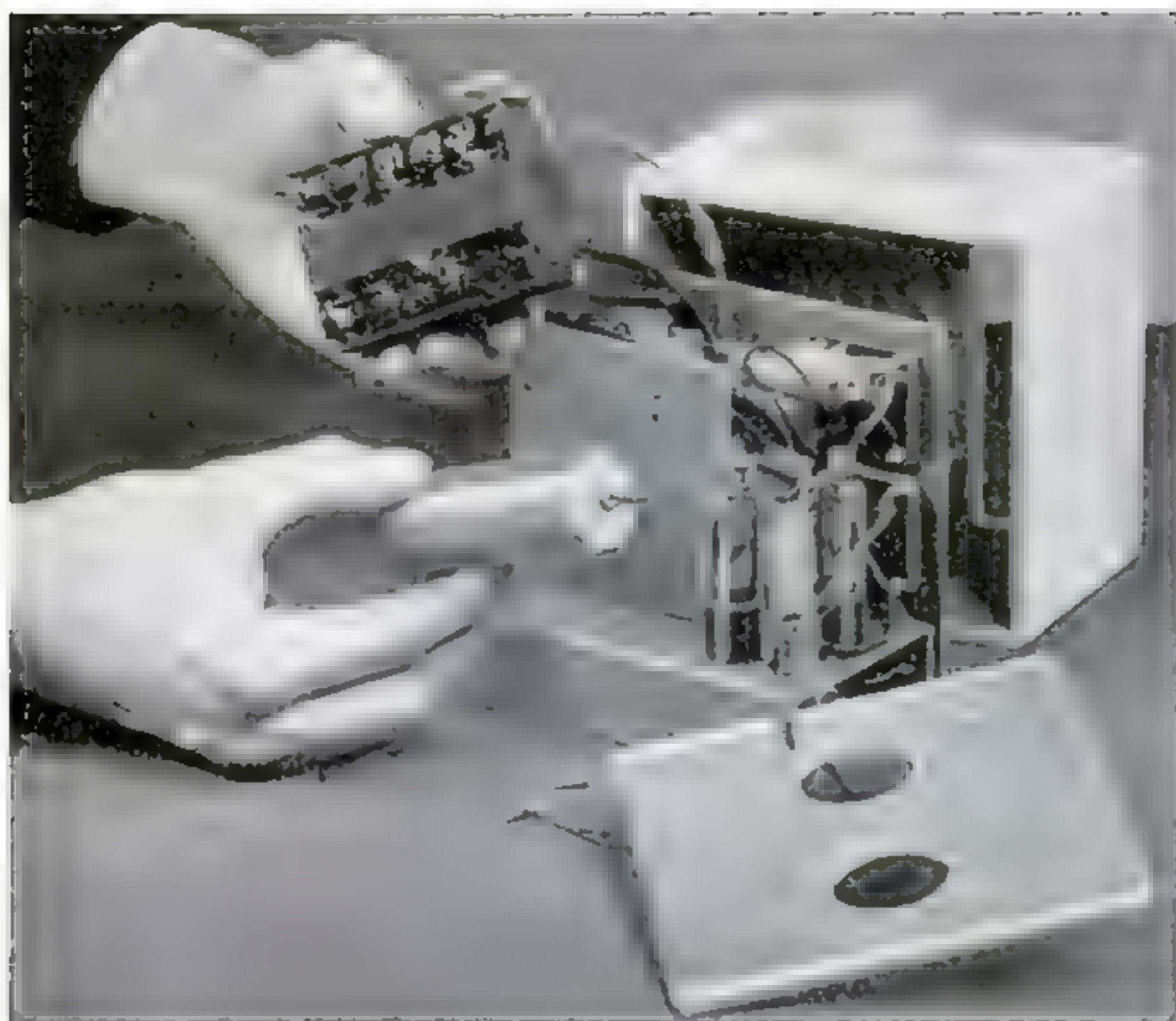
In arranging the battery power supply, it will be necessary to provide $67\frac{1}{2}$ volts of "B" battery, $1\frac{1}{2}$ volts of "A" battery, and $1\frac{1}{2}$ volts of "C" battery. To obtain the $67\frac{1}{2}$ volts of plate current, buy two midget 45-volt batteries and cut one of them in



Requiring no power connection, the receiver is ideal for terrace use



Three $1\frac{1}{2}$ -volt tubes are used in the tuned radio-frequency hook-up



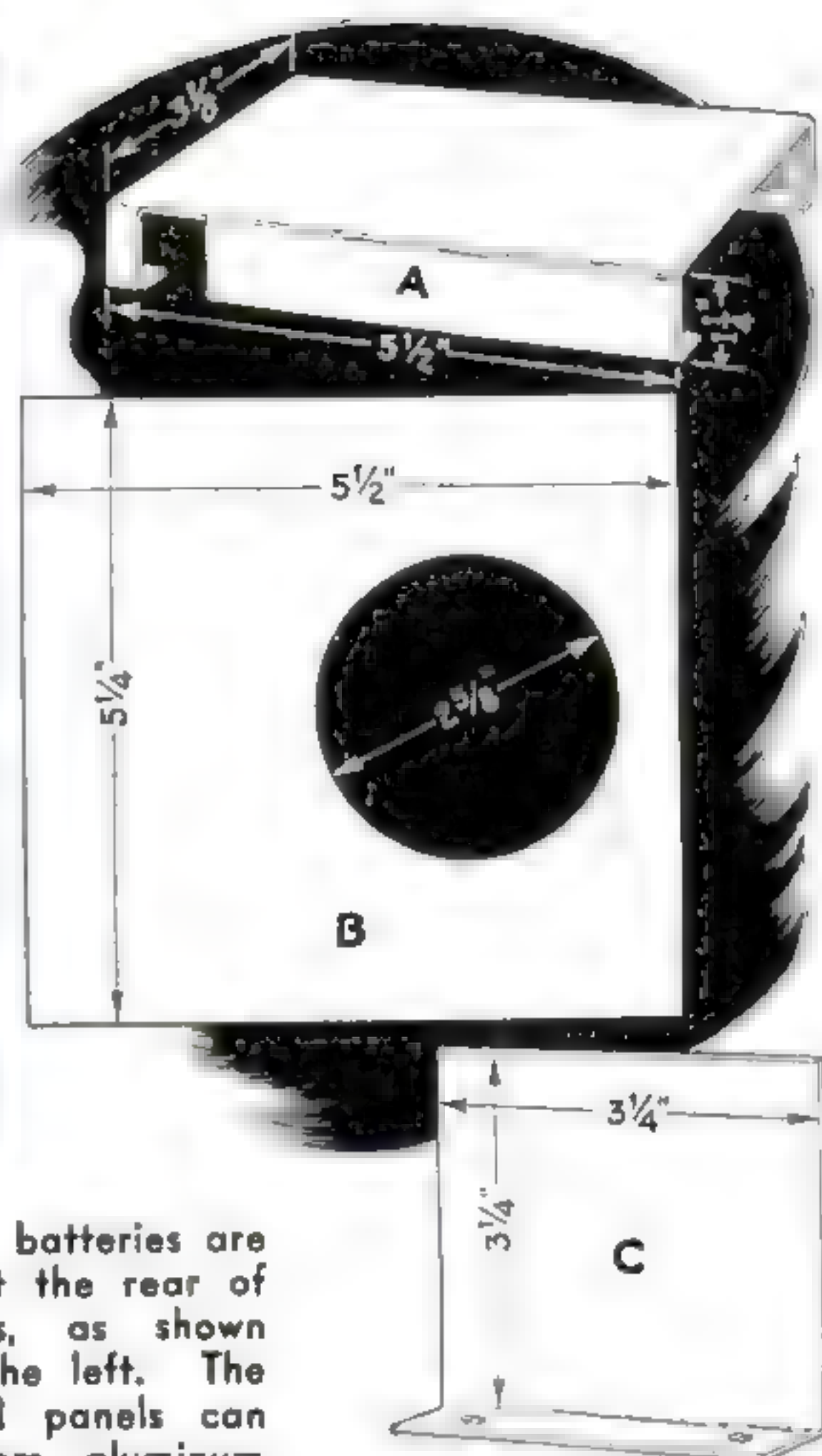
half to provide a $22\frac{1}{2}$ -volt source. The $22\frac{1}{2}$ -volt unit and the $1\frac{1}{2}$ -volt dry cell can be held in place on the transformer panel (C) with rubber bands or string. The 45-volt unit can be mounted conveniently under the chassis. A tiny $1\frac{1}{2}$ -volt flash-light cell of the type used in fountain-pen flash lights serves as the "C" battery and, being light enough to be supported by its own wiring, can be placed at the left of the speaker.

To provide maximum portability, the set is designed for use with two antennas—a long one about 40' in length and a shorter one approximately 25' long—instead of with an antenna and an actual connection to the ground. The long antenna is connected to the ground terminal on the receiver and the shorter one serves as the actual aerial. An actual ground can be used, of course, if desired.

The cabinet, measuring 6" square and $3\frac{1}{2}$ " deep outside, is made of $\frac{3}{8}$ " thick hard wood finished with quick-drying enamel in the desired color. The original shown is white. The modernistic handle is a silver and black metal drawer pull of the type available at most five-and-ten-cent stores for a dime. It blends in with the general modernistic design of the cabinet.

Two holes, one rectangular and the other circular, cut in the front of the cabinet provide openings for the aluminum control panel and the speaker. The speaker opening should be covered on the inside with silver and black speaker-grille cloth, to match the silver handle and the aluminum panel. Small black knobs should be used for the two tuning controls and the potentiometer. A dial need only be provided for the radio-frequency condenser, since the antenna circuit is not

Two of the batteries are mounted at the rear of the chassis, as shown above at the left. The chassis and panels can be cut from aluminum



LIST OF PARTS

Three-inch, permanent-magnet speaker.
Output transformer.
Tubes, XW (two), XY.
Midget antenna coil.
Midget radio-frequency coil.
Snap-on switch (D. P. S. T.).
Resistors, 1 meg., $\frac{1}{2}$ watt (two).
Resistor, 400,000 ohm, $\frac{1}{2}$ watt.
Volume control, 100,000 ohm.
Special tuning condensers, .0005 mfd. (two).
Mica condensers, .0003 mfd. (two).
Mica condenser, .002 mfd.
Tubular condensers, .02 mfd. (three).
Midget "B" batteries, 45 volt (two, see text).
Midget "C" battery, $1\frac{1}{2}$ volt.
Small "A" battery, $1\frac{1}{2}$ volt.
Miscellaneous:—Three special sockets, cabinet, chassis, panels, wire, etc.

critical in tuning. As in the making of all radio receivers, much of the success of your efforts depends upon careful workmanship. Make sure that all wire connections are soldered well. One loose connection or one that is not made with clean contacts can destroy a receiver's performance. Careful workmanship on the cabinet will reward the builder with a portable set that is sturdy.

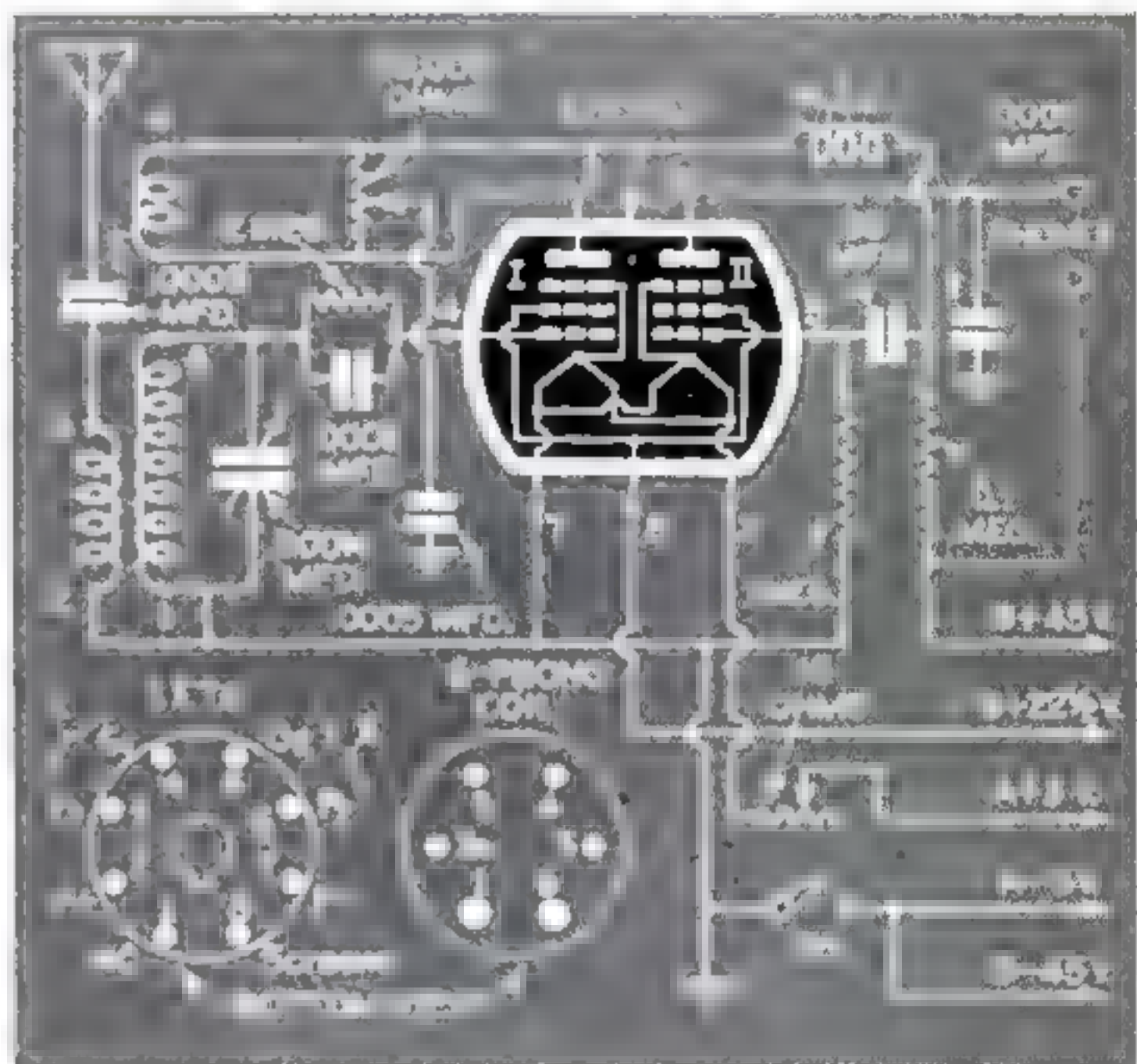
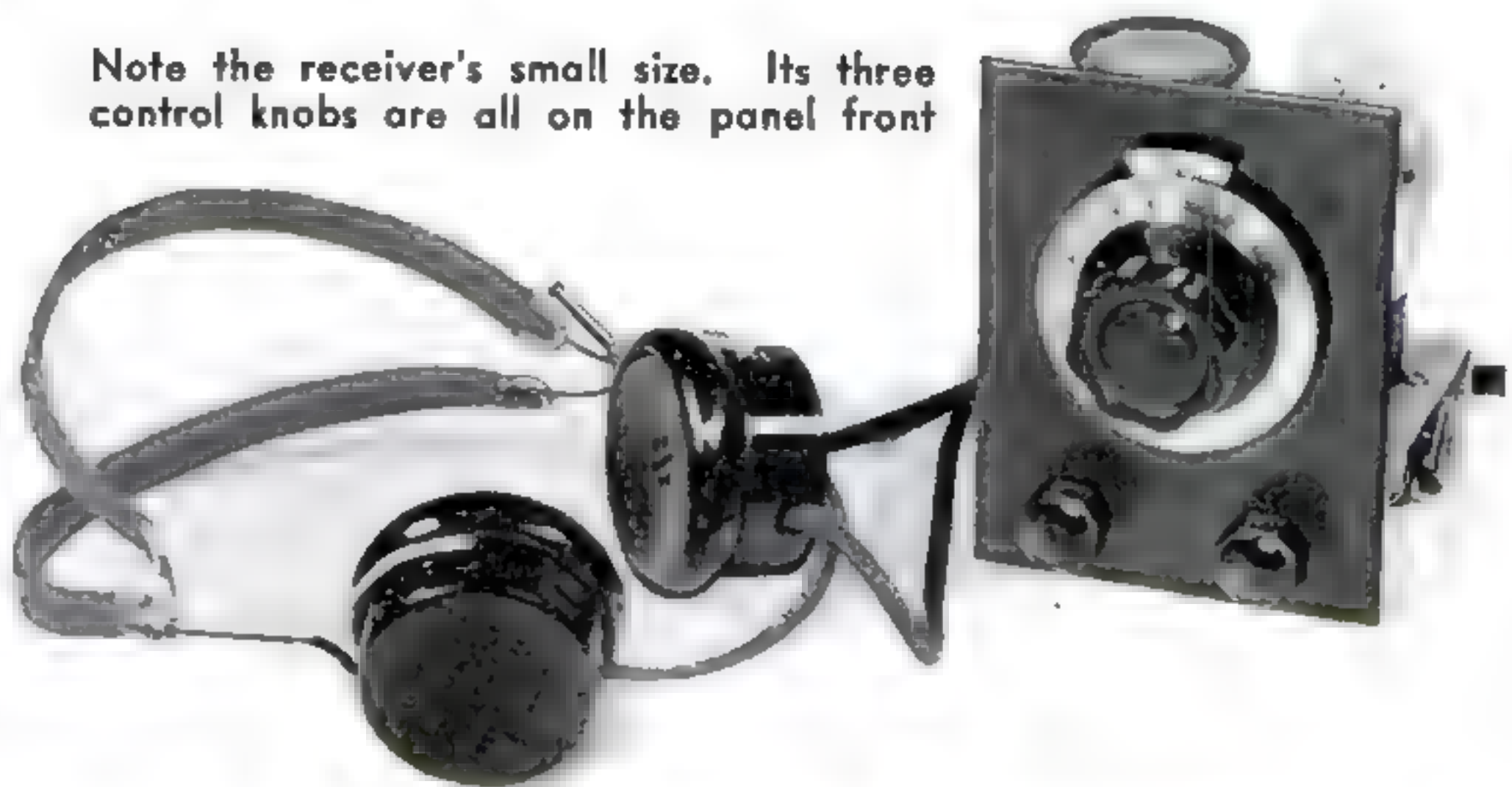
Compact All-Wave Set IS EASY TO BUILD

YOU should have no trouble getting world-wide reception with the all-wave set illustrated. It uses the new 1E7G tube containing two pentodes, independent of each other except for their connected screens, giving two-tube regenerative results in a one-tube set. A 15-ohm rheostat connected in the positive "A" lead regulates filament voltage, and a 20,000-ohm potentiometer across the tickler coil controls regeneration. The potentiometer is combined with an on-off switch.

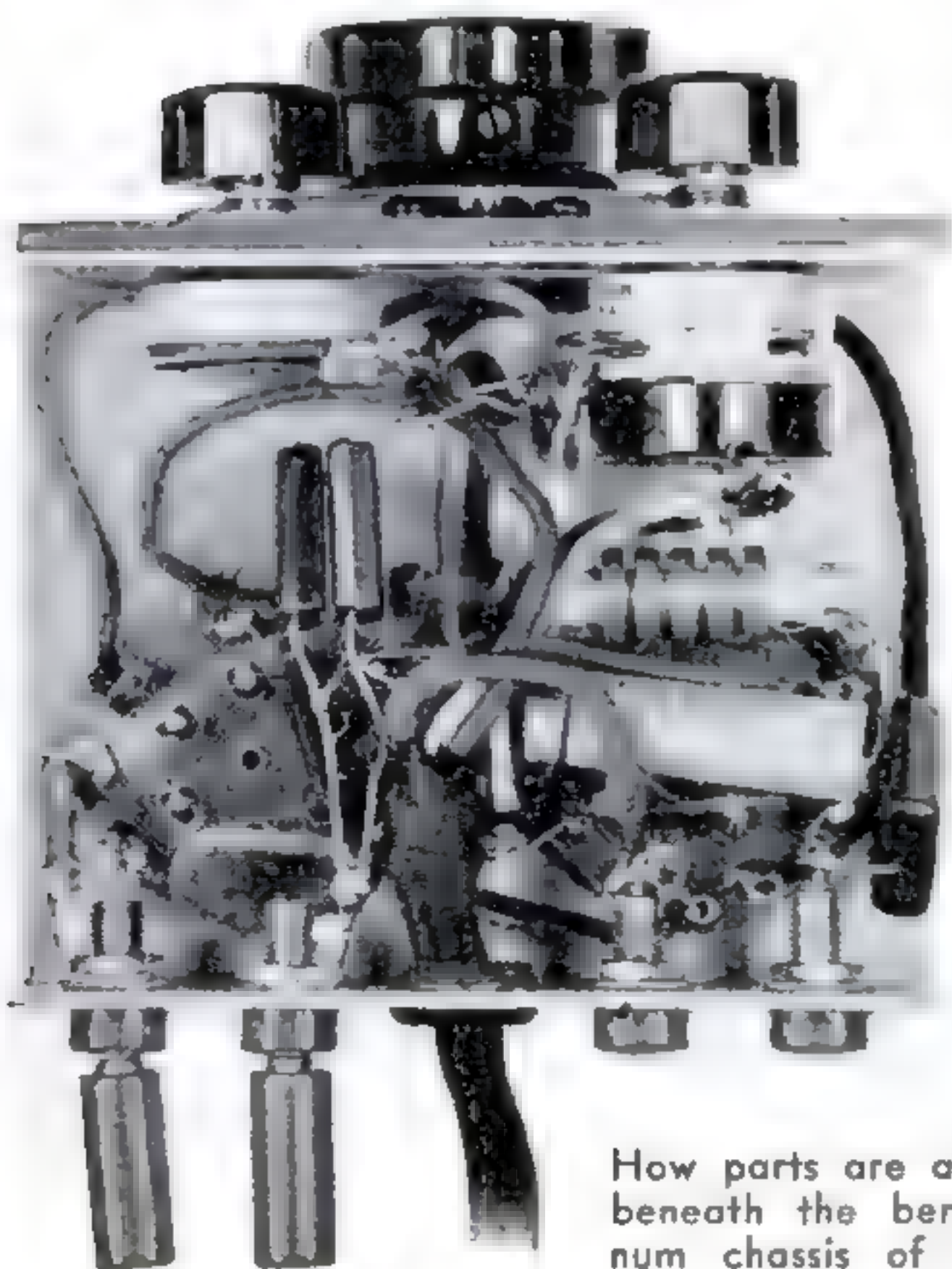
Since one pentode is used as a detector, the common screen voltage must be kept down to 22½ volts. Although this means a slight loss of volume in the audio stage, since the screen voltage on the "second" tube should be higher than 22½ volts for maximum amplification, the combined amplification of both stages is greater than that obtainable with two separate triodes.

To obtain regeneration, the author found it necessary to use coils of the type shown in the illustrations.—FRANK TOBIN.

Note the receiver's small size. Its three control knobs are all on the panel front



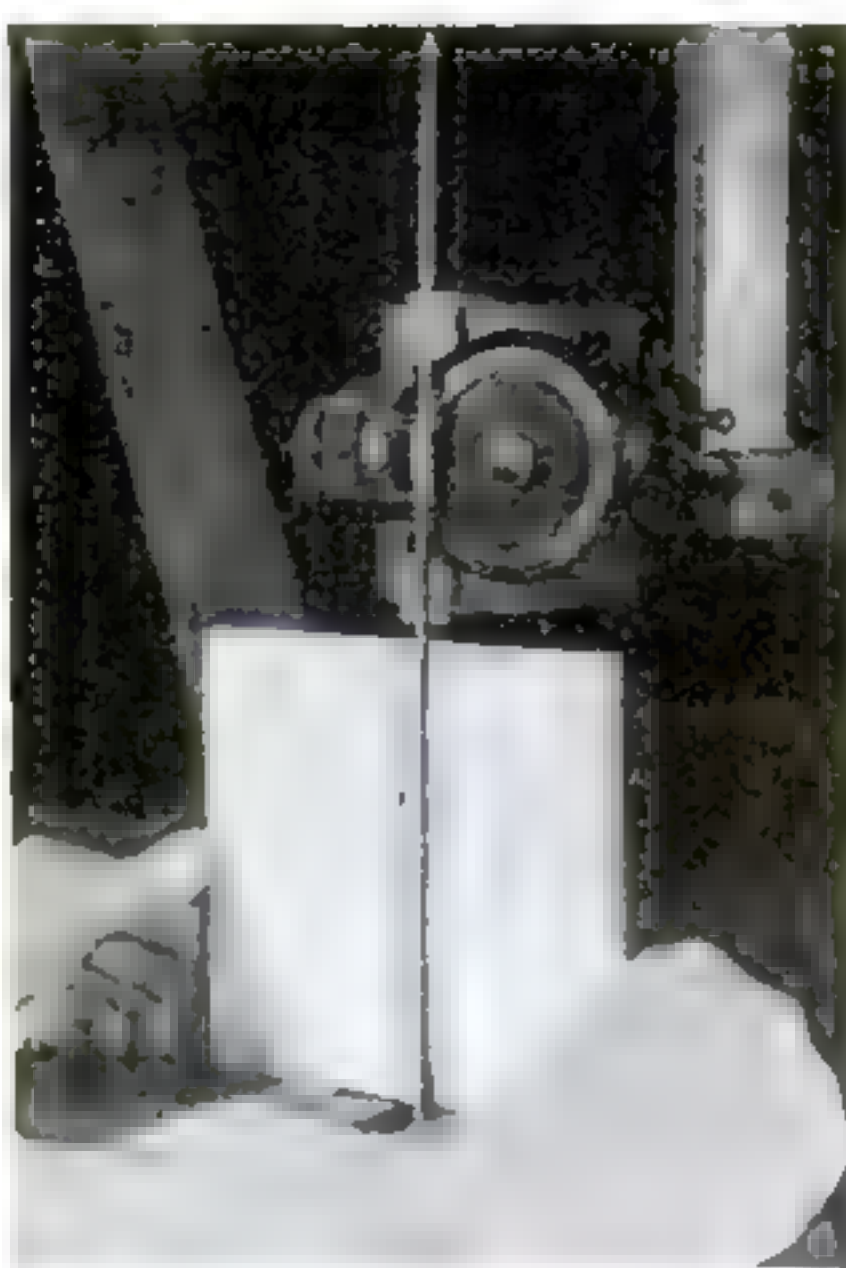
The diagram gives complete wiring details. Mount tube and coil sockets as below



How parts are arranged beneath the bent-aluminum chassis of the set



Setting a Band Saw to Cut Squarely

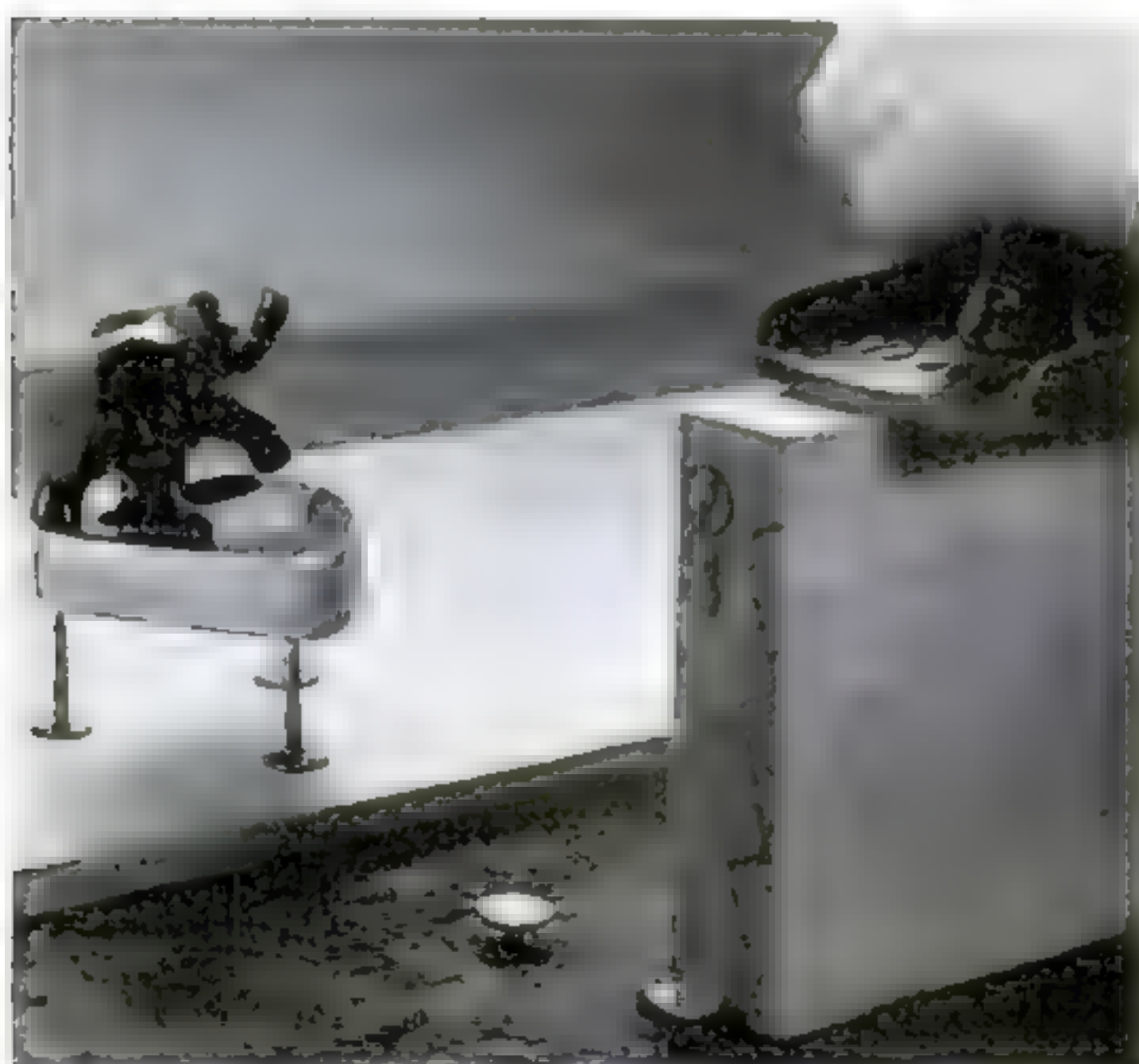


A shallow test cut is made in a piece of wood, which is then turned and placed behind the blade to see if the cut and blade coincide

TO SET the table of a band saw square with the blade, take any scrap piece of wood having a straight edge and make a saw cut as shown. Then turn the piece around to bring the saw cut to the front, and place the wood back of the blade. If the saw cut and the blade form two sides of an angle, tip the table as required and repeat the test. Continue until you succeed in making a test saw cut that will permit the blade to fit in the cut when the wood is placed at the back of the saw.—E. C. H.

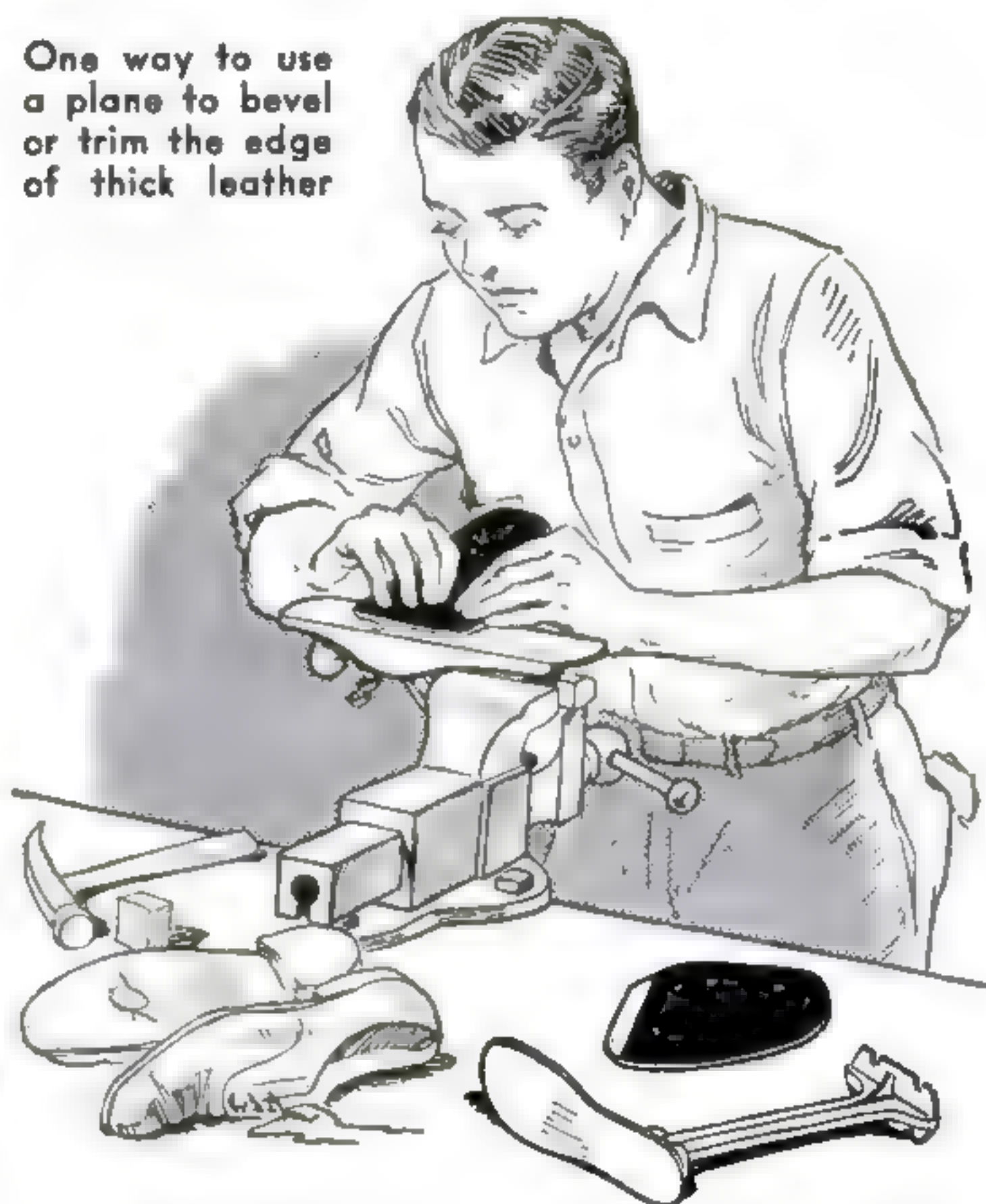
Flathead Roofing Nails Help in Bench Work

FLAT, large-headed roofing nails are handy accessories for a variety of bench work in the shop. For example, they make excellent temporary bench stops, and when turned upward on their heads are serviceable supports for small, freshly painted objects as shown below. A third use, not illustrated, is that of small hold-down clamps. Fitted with felt or leather washers, they will hold overlay carvings and plaques to a larger piece of wood while carving or routing these pieces.



Nails hold a painted object and act as planing stop

One way to use a plane to bevel or trim the edge of thick leather



Plane Trims Thick Leather

IN REPAIRING leather goods, an ordinary plane is handy for beveling the ends of belts, straps, shoe soles, and the like. When the work is wide, tack it on a block of wood and square a line across at the back of the bevel. The plane can also be clamped upside down in the vise, provided care is taken not to damage it, and used to trim half soles.—R. D.

Celluloid Shield Attached to Chisel Protects Face from Flying Chips



IN CHIPPING masonry or concrete with a cold chisel, the danger of injury from flying chips can be eliminated by using a transparent celluloid shield from 8" to 12" in diameter. A hole is cut in the center of the shield large enough to take the cold chisel to be used; then a short piece of rubber tube is split lengthwise and attached to the celluloid with rivets or small bolts and washers as shown at the left. The tube should be of such size as to stretch over the chisel and hold the shield firmly in place. This device is particularly helpful for overhead chipping.—LAWRENCE N. OLSEN.



Five-Prong Plug Connects Trailer Light Wires

BECAUSE many states now require that direction signals and clearance lights be carried on trailers as well as the ordinary stop and tail lights, it is quite common to have to connect or disconnect at least five wires every time a trailer is hitched or unhitched.

A neat connector can be made from an old radio tube and socket. Remove the glass and wires from a 224 tube or other five-prong tube. Use pieces of No. 14 rubber-covered wire and solder them as shown. Fill in around the wires with a plastic composition wood or

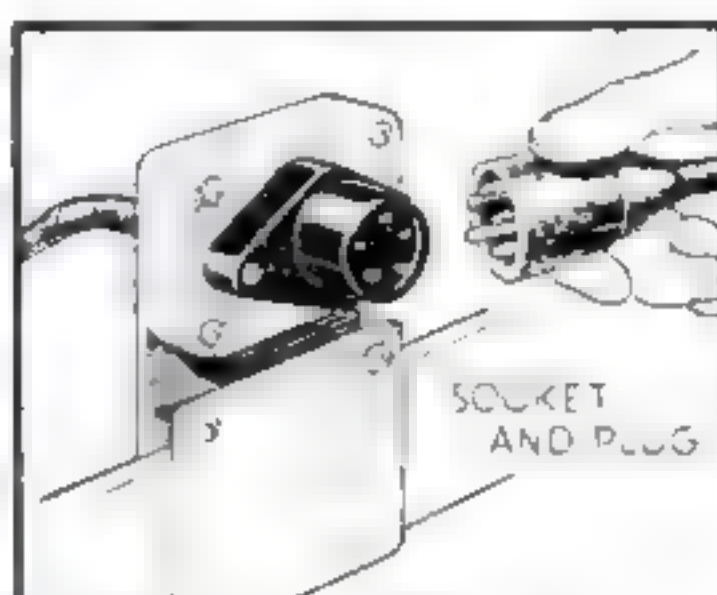
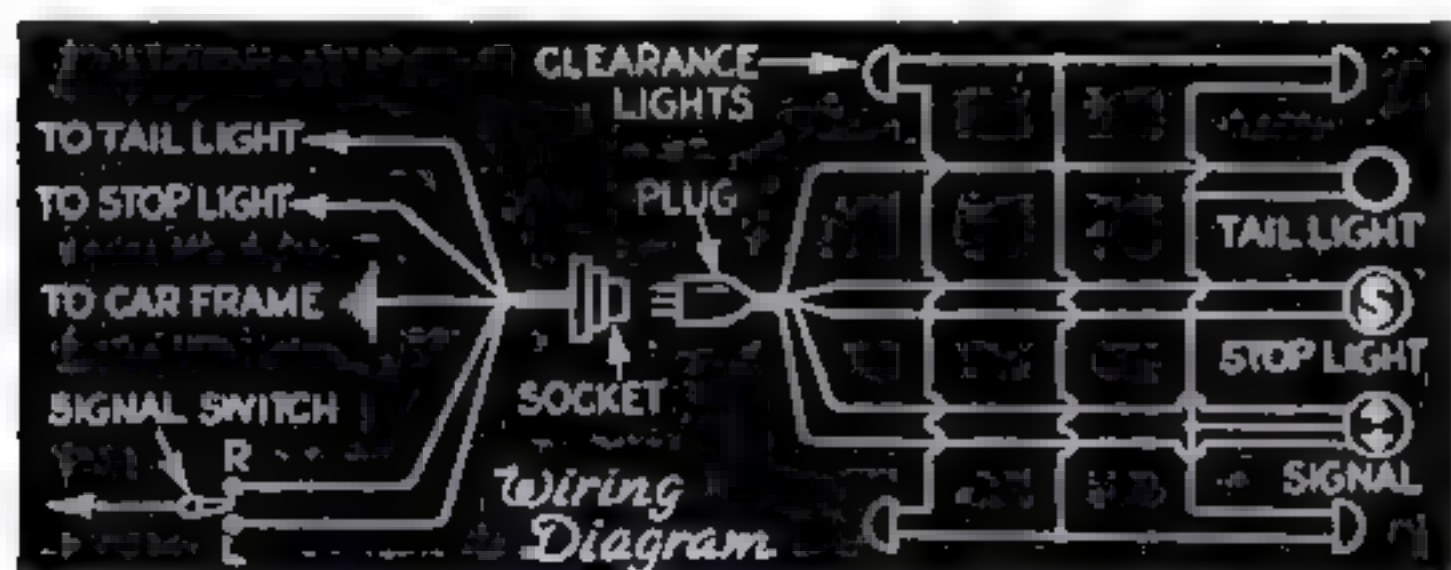
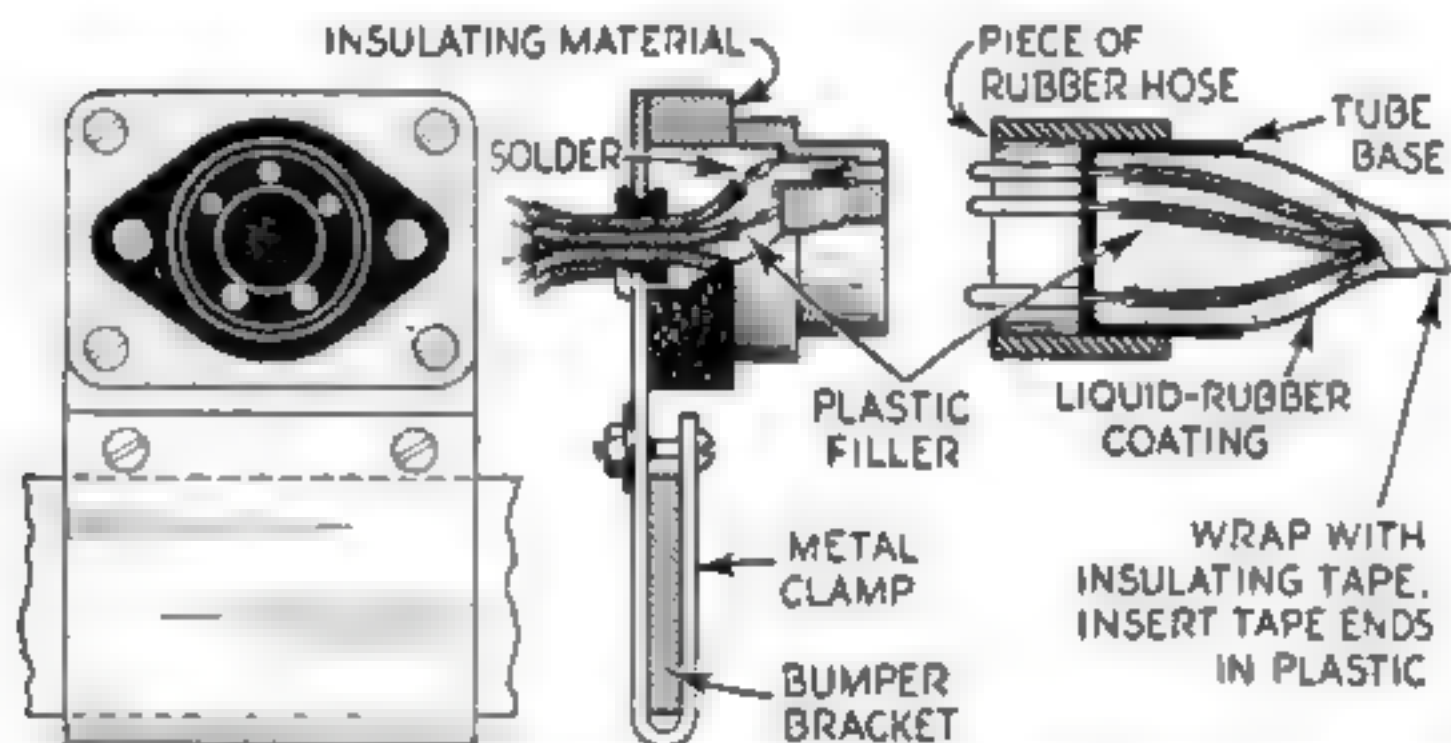


insulating compound, and cover over wires and wood with liquid rubber.

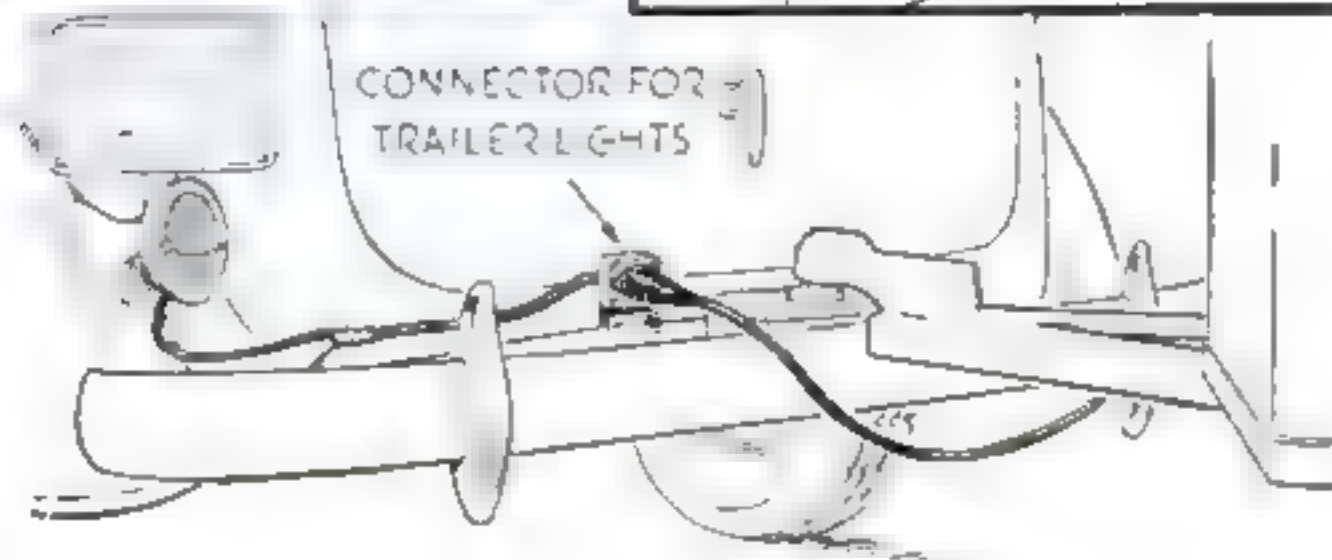
The socket should be of the push-in type and can be attached to a bracket. Use a piece of insulating material between the socket and the metal part of the bracket. Solder wires to the socket prongs and embed them in back of the socket with the wood composition.

I find that the plug remains in place by itself, but to make sure that it cannot get loose, an arm can be built on the bracket so

that a lock screw or pins can be inserted in the plug to prevent it from backing out of the socket. A piece of rubber hose should be slipped over the plug, leaving enough projecting to cover the socket boss. Also, a rubber cap, such as those for covering babies' milk bottles, can be used to cover the socket when the trailer is detached from the towing car.—A. M. WHYTE.



The connector plugs in as easily as an ordinary radio tube. Its construction and wiring are illustrated above

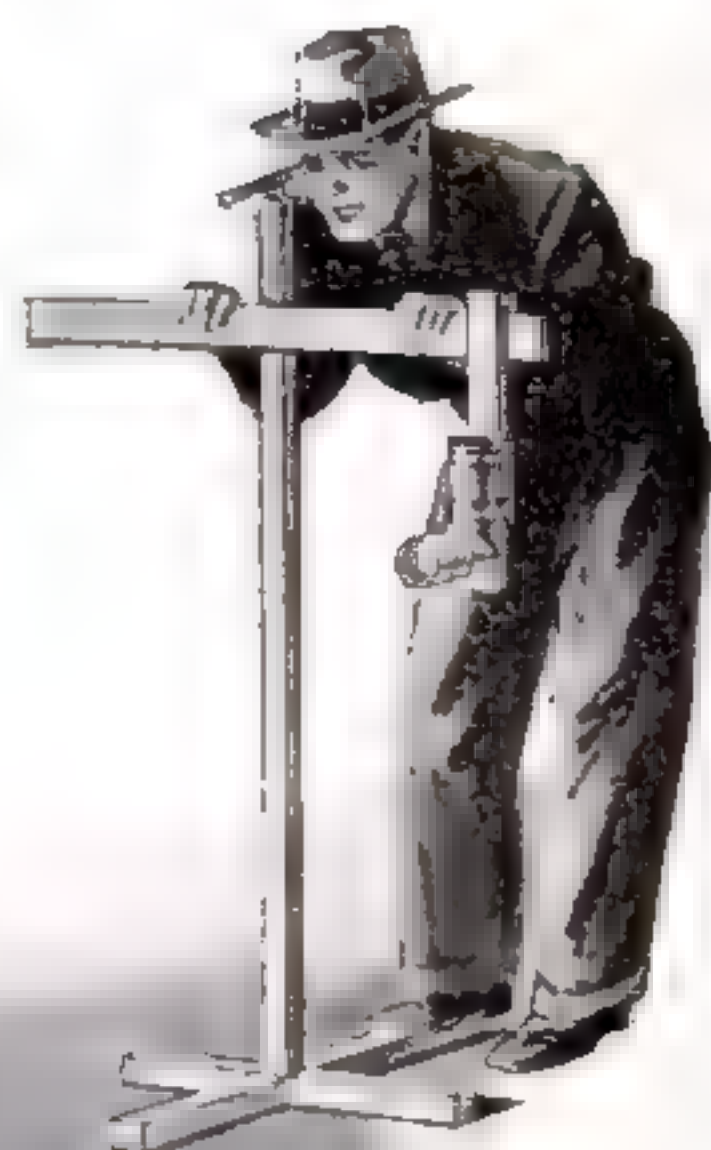


Headlight Tester for Car Owners



The "photometer" shows the center of the beam

Sighting on the center of a car hood to line up the unit for a headlight test



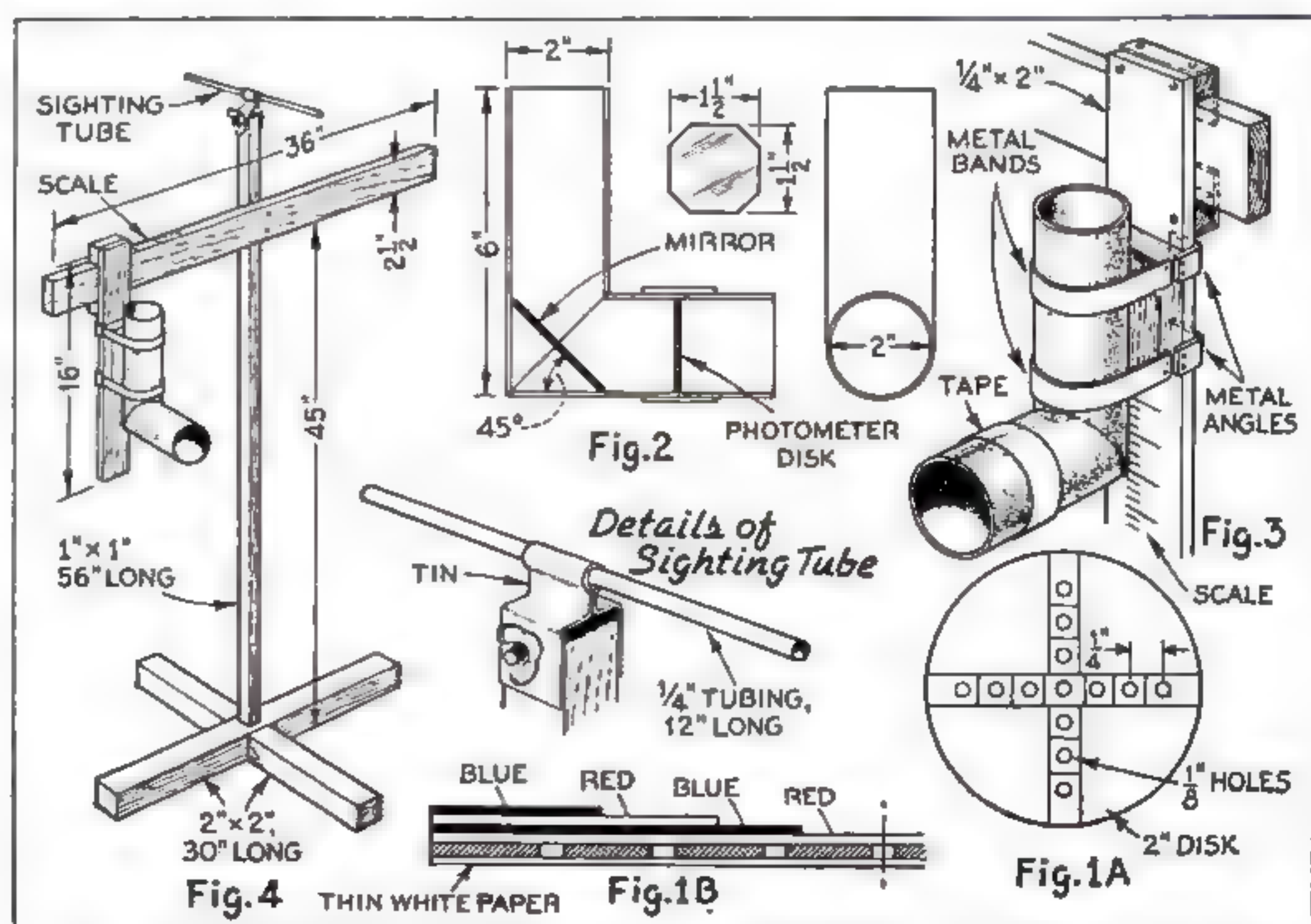
YOU can adjust the aim of your car's headlights accurately with this easily made, inexpensive tester. The heart of the unit is a homemade "photometer" which tells you when it is in the center of a headlight beam by the intensity of the light that penetrates it. Knowing the proper setting for your lights, all you do is line the device up 6' in front of your car, "get a bead" through the sighting tube on the car's center line, take readings, and proceed with the necessary lamp adjustments.

The photometer is made from a 2" disk of cardboard. Draw diameters on the disk, intersecting at right angles. With a paper punch or drill, make a $\frac{1}{8}$ " hole in the center and at $\frac{1}{4}$ " intervals along each line as in Fig. 1A. Now lay strips of red transparent cellulose to cover all the holes. Next, as indicated in Fig. 1B, lay strips of similar blue material so the outer three holes in each line are covered. Cover the two outer holes with another layer of red, and finally the outside holes in each

line with still another layer of blue cellulose.

Cement a disk of thin white paper over the entire back of the photometer disk. Hold it against a strong light and mark the paper covering each "window," starting with "1" for the center hole, "2" for the four adjacent holes, and so on. Mark the figures so that they all can be read without having to turn the disk.

Glue together at *(Continued on page 200)*



Follow the details shown in this drawing carefully in constructing the tester



Eastman's "EASY-ON-THE-POCKETBOOK" Miniatures

for both black-and-white and
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Introduced at decidedly attractive prices, they are even more tempting bargains today—thanks to Eastman's recent price reductions. Equipped with fast lenses and shutters, modern and worth-while refinements, they offer exceptional versatility and picture-making certainty. All give you beautiful full-color Kodachrome transparencies, as well as superb black-and-white pictures. At your Kodak dealer's . . . Eastman Kodak Company, Rochester, N. Y.

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GOING TO THE NEW YORK FAIR? Be sure to take your Kodak. Stop at the Kodak Building, where Eastman experts will advise you what to take and how to take it. And there you'll see the unique and gorgeous Cavalcade of Color—the **GREATEST PHOTOGRAPHIC SHOW ON EARTH**. Nothing like it has ever been seen before. Don't miss it.

1 Kodak 35, Kodak Anastigmat *f*.5.6 lens, and Kodex shutter (3 speeds to 1/100 second), \$14.50—a new low price.

2 Kodak 35, Kodak Anastigmat *f*.4.5 lens, Diomatic shutter (4 speeds to 1/150, delayed action), \$24.50—a new low price.

3 Kodak 35 with Kodak Anastigmat Special *f*.3.5 lens and Kodamatic shutter (5 speeds to 1/200, delayed action), \$33.50—a new low price.

Kodak 35's make 35 mm. negatives that, through modern photofinishing methods, yield big 2½x4-inch black-and-white prints. Have fast lenses, precision shutters, eye-level finders, finger-tip focusing, automatic exposure counter. Load with Kodachrome (full-color) Film as well as black-and-white.

4 Kodak Bantam *f*.5.6, with Kodak Anastigmat lens, 1/100-second shutter, folding optical finder, film-centering mechanism, \$14—a new low price.

5 Kodak Bantam *f*.4.5, Kodak Anastigmat Special lens, 1/200-second shutter, plunger-type body shutter release, film-centering device, \$22.50—a new low price.

Kodak Bantams lead to black-and-white pictures as big as themselves; modern photofinishing methods give you 2½x4-inch prints. And both of the models above also take Kodachrome Film.

Homemade Headlight Tester for Motorists

(Continued from page 198)

right angles 3" and 6" lengths of mailing tube of 2" diameter (Fig. 2). Cut the corners from a 1½" square pocket mirror and slip it down into the joint of the unit so that it is at an angle of exactly 45 degrees. Fasten it in place with glue and small pieces of wood. Glue the photometer to the end of the shorter tube—paper side toward the rear and numbers upside down.

The standard (Fig. 4) should be made next. Use well-seasoned hard wood that will not warp. If your headlights are wider apart than 36", make the crosspiece longer, accordingly. "Square up" everything, and make the fittings snug and the joints strong.

The vertical and horizontal slides should be provided, as indicated, with markings ¼" apart, above and below and to the right and left of zero. The limits of these markings will be determined by the motor-vehicle laws of the state, which usually allow certain tolerances in the variation of the headlight-beam center.

The slide with the photometer unit attached is now slipped on one arm of the stand. By sighting on the center of the motor hood, you can quickly center the tester, and by swinging the sight vertically, you can set the tester at right angles to this center line.

With the tester 6' from the lamps, slide the photometer from side to side within the beam of one headlight. You will see the horizontally numbered windows on the photometer disk light up and go out. The center of the beam is located when the windows on either side of the numeral "1" are equally lighted. As a rule, the beam center should not vary more than 1" either side of the lamp center at a distance of 6'.

Sliding the photometer vertically will locate the vertical center of the beam. In most states, the law requires that this be not more than 36" high at 6', with tolerance between 35" and 36¼".

With the photometer slide mounted on the other side of the cross arm, the other headlight can be tested.

Fixing Windshield Wiper

IF YOUR windshield wiper is of the vacuum-powered type and does not work properly, one of the first places to look for trouble is in the rubber-hose connections. The simplest way to do this is to remove each one, hold one end closed, and blow cigarette smoke into the other end. Leaks will show up immediately.



Yes, Siree — owning a motorcycle is great sport these days! No more nothing-to-do days! Enjoy plenty of action and fun every day — and make lots of new friends. Go in for gypsy tours, reliability and endurance runs, hillclimbs, tourist trophy races, and other thrill-packed motorcycle events. Join a live-wire riders' club. Visit your Harley-Davidson dealer — find out about the great fun club members everywhere are having — and get an eyeful of the latest model Harley-Davidsons. Also ask about his Easy Pay Plans — and above all, be sure to mail the coupon NOW!

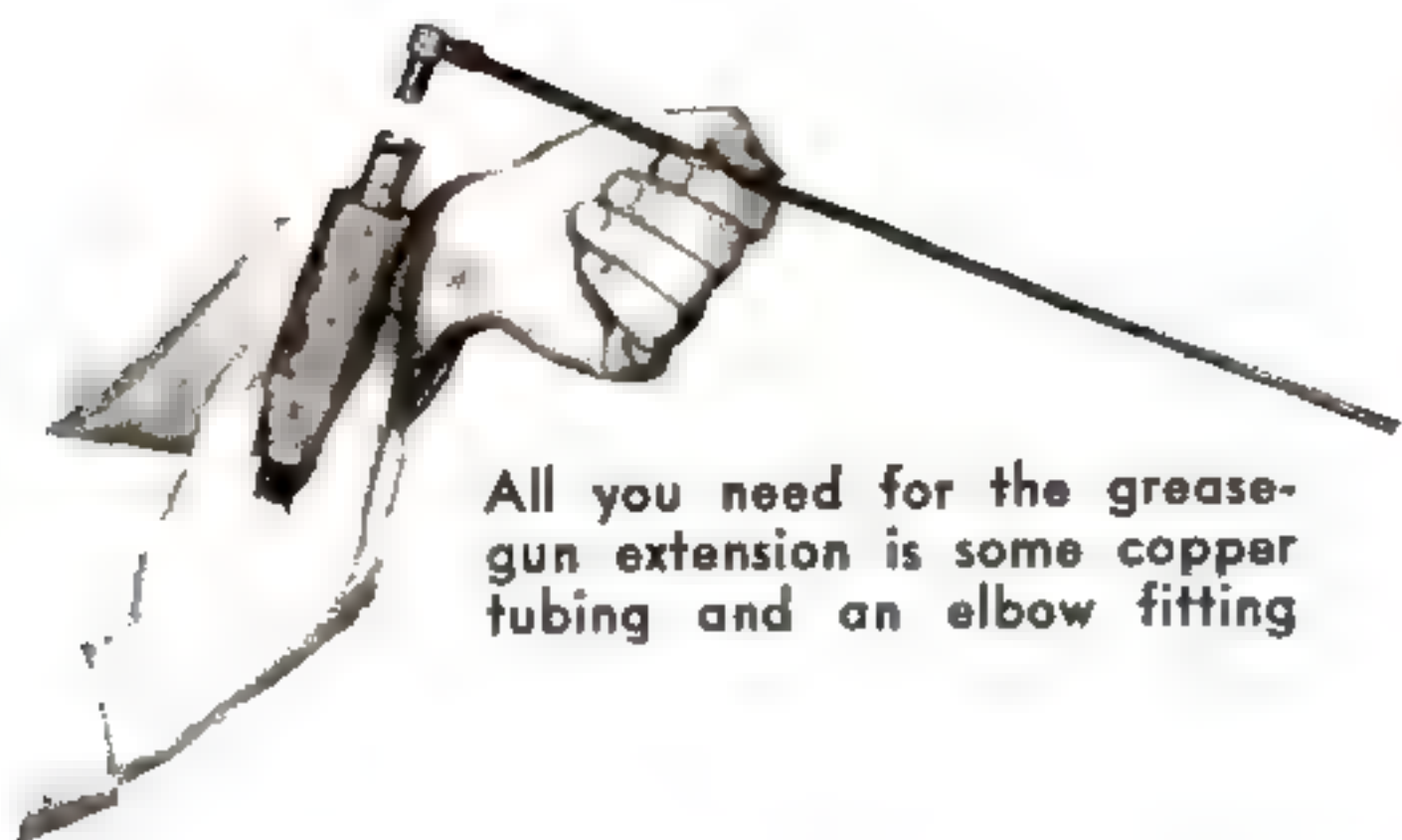


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Please send illustrated literature on Motorcycles and FREE copy of "ENTHUSIAST," Motorcycling Magazine. Stamp is enclosed for mailing cost.

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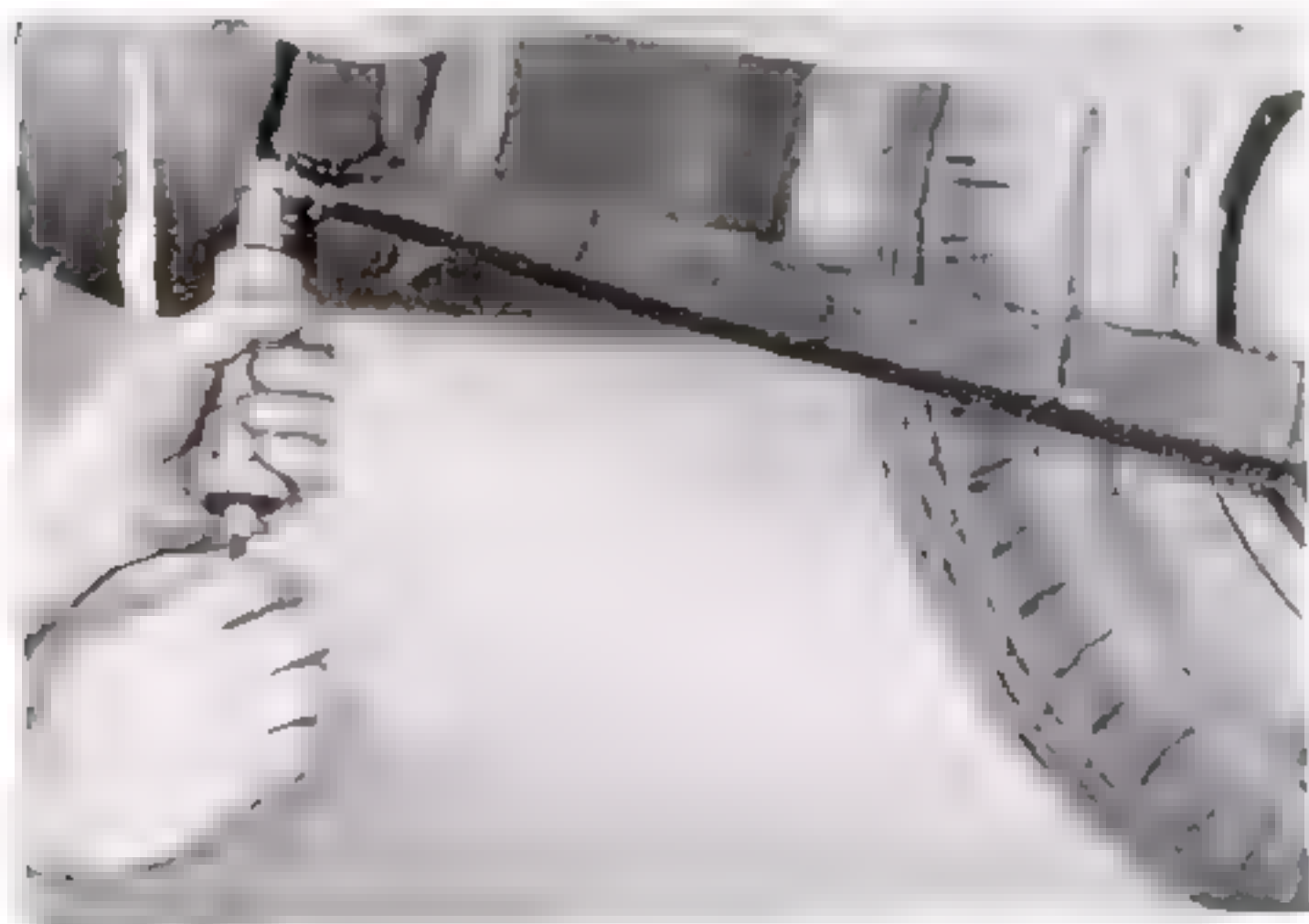
Address _____



All you need for the grease-gun extension is some copper tubing and an elbow fitting

Grease-Gun Fitting Oils Metal-Covered Springs

THOROUGH greasing jobs on automobile springs which are incased in metal dust covers are difficult. To simplify the procedure, make the handy extension tube illustrated on this page, and fit it to your high-pressure grease gun. To make the device, obtain a 16" length of 3/16" copper tubing. Solder one end of the tubing to an elbow-type, high-pressure grease fitting, which you can readily obtain at any garage, and flatten the other end of the tube slightly so that it can be inserted between the spring and the metal cover. It may be necessary to open up the end of the cover a trifle with a screw driver. Beyond the end, there will be sufficient clearance between the spring and the cover to allow the tubing to be worked in for about half of its length. With your grease gun coupled to the elbow fitting, the space within the spring cover can be filled with a light-bodied, graphite grease. Force the grease in until it runs out each end of the cover. Then with a few light hammer taps, close the end of the cover again. The flexing of the spring in driving will force the grease around and between the leaves. Because the fitting reaches well inside of the spring cover, you can be sure that the cover is well packed with grease as soon as it starts to run out of the ends.—R. J. W.



To use the device, one end of the spring cover is opened slightly so the tube can be inserted

YOU NEED



for
POWER, ECONOMY, SAFETY

HERE'S WHAT CERTIFIED RE-WIRING MEANS TO CAR OWNERS

The importance of re-wiring has long been recognized. Corroded, frayed, or undersize cables and loose or dirty connections cause hard starting, poor gas mileage, loss of power, inefficient lighting and accessory performance, and even dangerous fires.

But, until the introduction of CERTIFIED RE-WIRING, the car owner had no assurance that the re-wiring work would be done thoroughly and expertly, or that replacements would be made with highest quality cable of the correct gauge.

Certified Re-Wiring takes the guesswork out of re-wiring service. The mechanic who does the work has been trained in the latest, most satisfactory method of checking for defects in the electrical system—he has a Certificate to prove it. Only Packard cable of the correct gauge is used in replacement—and Packard is the recognized quality cable of the automotive industry. In other words, you are assured that the job will be satisfactory.

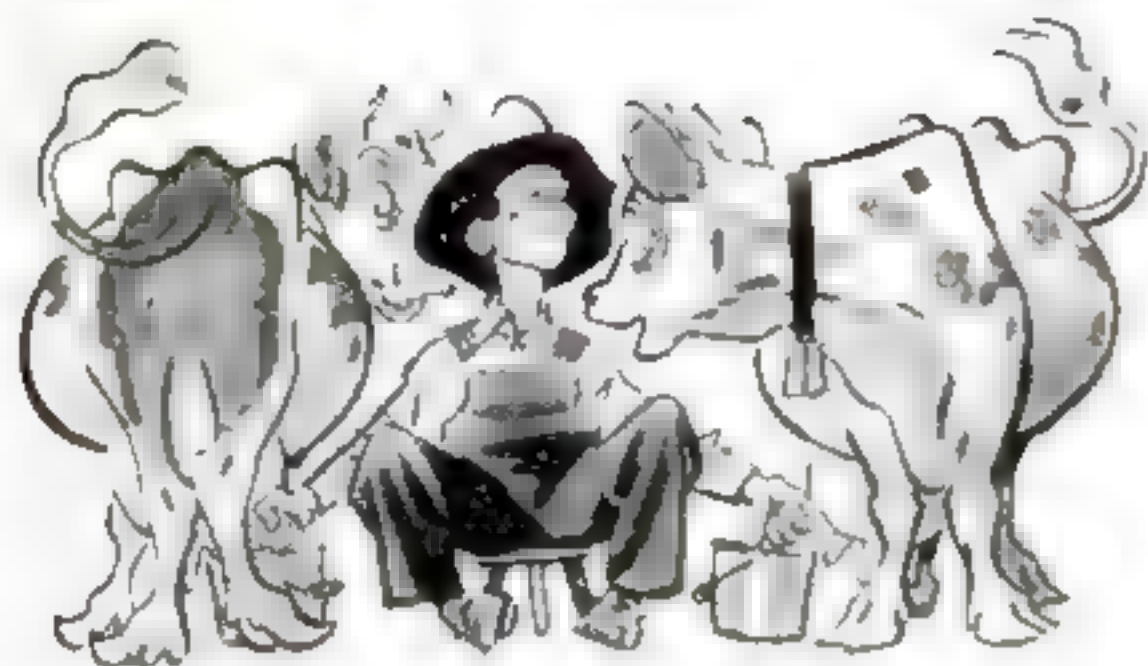
WHERE CAN YOU GET AUTHORIZED CERTIFIED RE-WIRING SERVICE?

Authorized Certified Re-Wiring Service may be identified by the blue and gold metal sign. Other service stations have mechanics who have received their Certified Re-Wiring Certificates. Ask to see the mechanic's Certificate, and be sure that Packard cable is used in your re-wiring job. Packard Electric Division, General Motors Corporation, Warren, Ohio.

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THE STANDARD WIRING EQUIPMENT OF THE AUTOMOTIVE INDUSTRY

DOES TWO JOBS AT ONCE



NEW SPEEDY WAX (LIQUID)

MADE BY DU PONT

CLEANS the car....
Gives a WAX POLISH
—at the same time!



Sure, putting a wax polish on your car used to be a long, tough job. But not today. With new Du Pont Speedy Wax, you can now give your car a grand wax finish in half the time.

Speedy Wax cleans as it waxes. And what a mirror-bright lustre it leaves—a lustre that lasts. Speedy Wax is fine for *all* car finishes. Try it.



➔ **Sample for you...** We'll gladly send you a generous sample of Speedy Wax—enough to shine up the fenders and hood. Just send 6¢, to help cover postage, to Du Pont, Dept. SP-3, Wilmington, Delaware.
(Offer good in U. S. only)

LEAKY AUTO TOPS, of black fabric, are easily fixed with DU PONT "THICKOTE." It seals cracks, and produces a beautiful and long lasting, jet-black glossy finish.



FULL-SIZE BLUEPRINTS for Building Ship Models

WHEN you build a ship model, full-size blueprints are of inestimable help. You can take dimensions right off the drawings and compare the completed parts directly with them in respect to size and shape. Plans are available for about fifty different models. We also have blueprints drawn to scale for many other projects. If you do not see what you want in the list below, send a stamped, self-addressed envelope for our complete list.

MODELS

BLUENOSE, famous fishing schooner, 17½" hull, 110-111-112-R	1.00
Clipper Ship GREAT REPUBLIC, 31½" hull, 272-273-274-R	1.25
Clipper Ship SEA WITCH, 9½" hull, 219 .....	.25
Coast Guard Patrol of 165-ft. Type, 20½" hull, 286-287-R .....	.75
Concord Stagecoach DIAMOND TALLY-HO, 20½" long, 115-116-117-R	1.00
Confederate Raider ALABAMA, 21½" hull, 335-336-337-R	1.50
Elizabethan Galleon REVENGE, 21" hull, 208-209	1.00
Fishing Schooner WE'RE HERE of "Captains Courageous," 9½" over all, 351-R .....	.50
H. M. S. BOUNTY, 8½" hull, 254 .....	.25
Liner QUEEN MARY, 10¼" hull, 283 .....	.25
NOURMAHAL, power yacht, 8½" hull, 276 .....	.25
Ocean Freighter, 14" hull, 271 .....	.25

(Construction kits are available for some of these models. Turn to page 204.)

BOATS

Cabin Cruiser, 17' long, for use with outboard or inboard drives, 356-357-358-359-R	\$1.50
Camper's Utility Boat, 11' 2" long, canvas-covered, for outboard motor or rowing, 281-R .....	.50
Canoe, 16' canvas-covered kayak; can be used with sail, 192-193-194-R	1.00
Canvas-Covered Duck Boat, 13' 6" long, 279-R .....	.50
Fisherman's Outboard Boat, 9' 3" or 11' 6" long, weighs 115 or 160 lb., for motors from 3 to 16 h.p.; can also be rowed, 344-345-R .....	.75
Motorboat-Rowboat, 13' long, decked hull, for use with outboard or inboard drives, 147-R .....	.50

(Continued on page 203)

NEW PHOTO BOOKLET FOR AMATEURS



PREPARED especially for amateur photographers who wish to make their own equipment, this booklet tells in clear, non-technical language how to fit up a dark-room and how to construct the following: printing box, washing tank, enlarging camera, darkroom clock, drying press, photoflash synchronizer, fixed-focus en-

larger for miniature films, and many other accessories. The price is 50 cents. Be sure to inclose remittance because no C.O.D. orders will be filled.

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(Continued from page 202)

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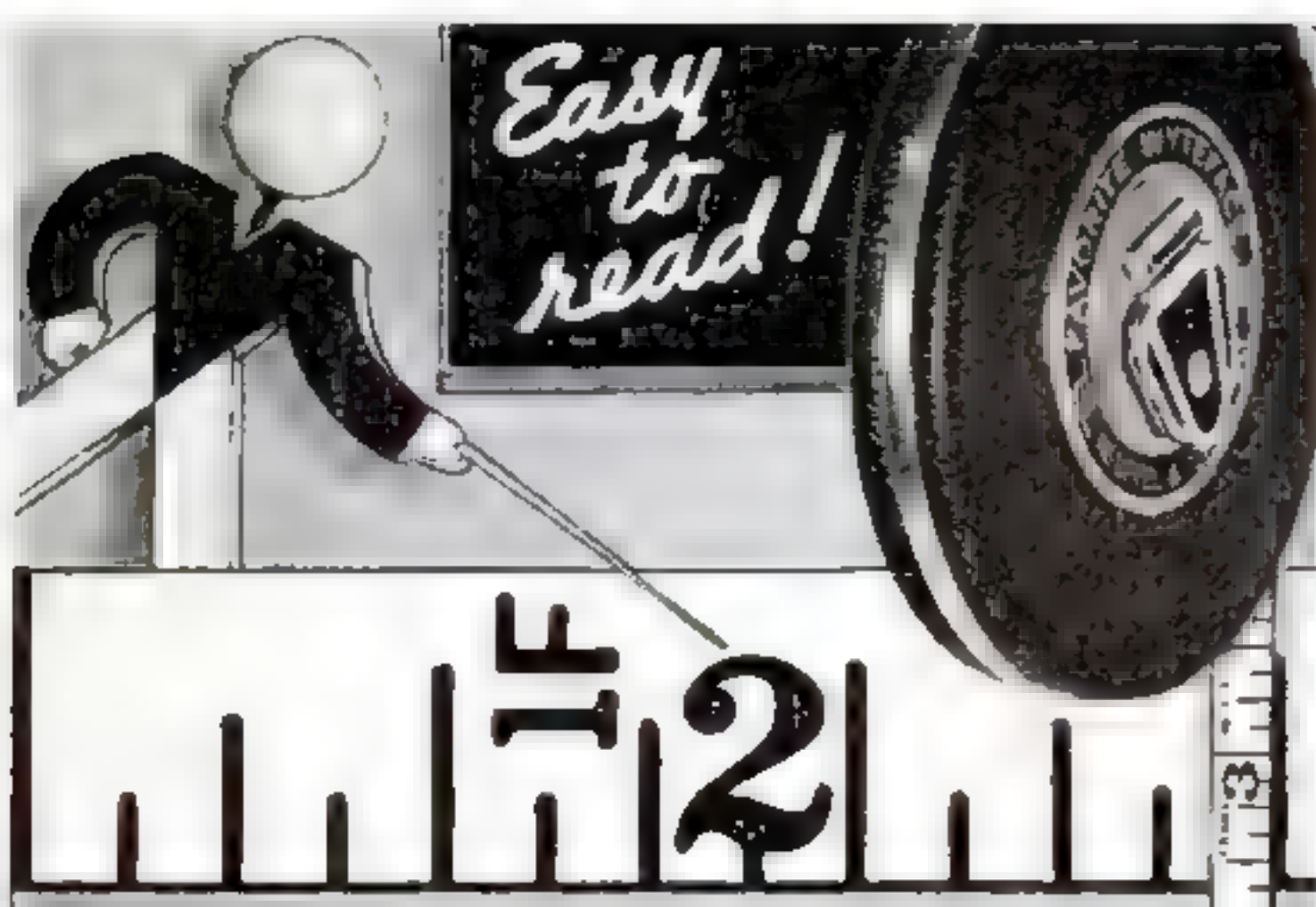
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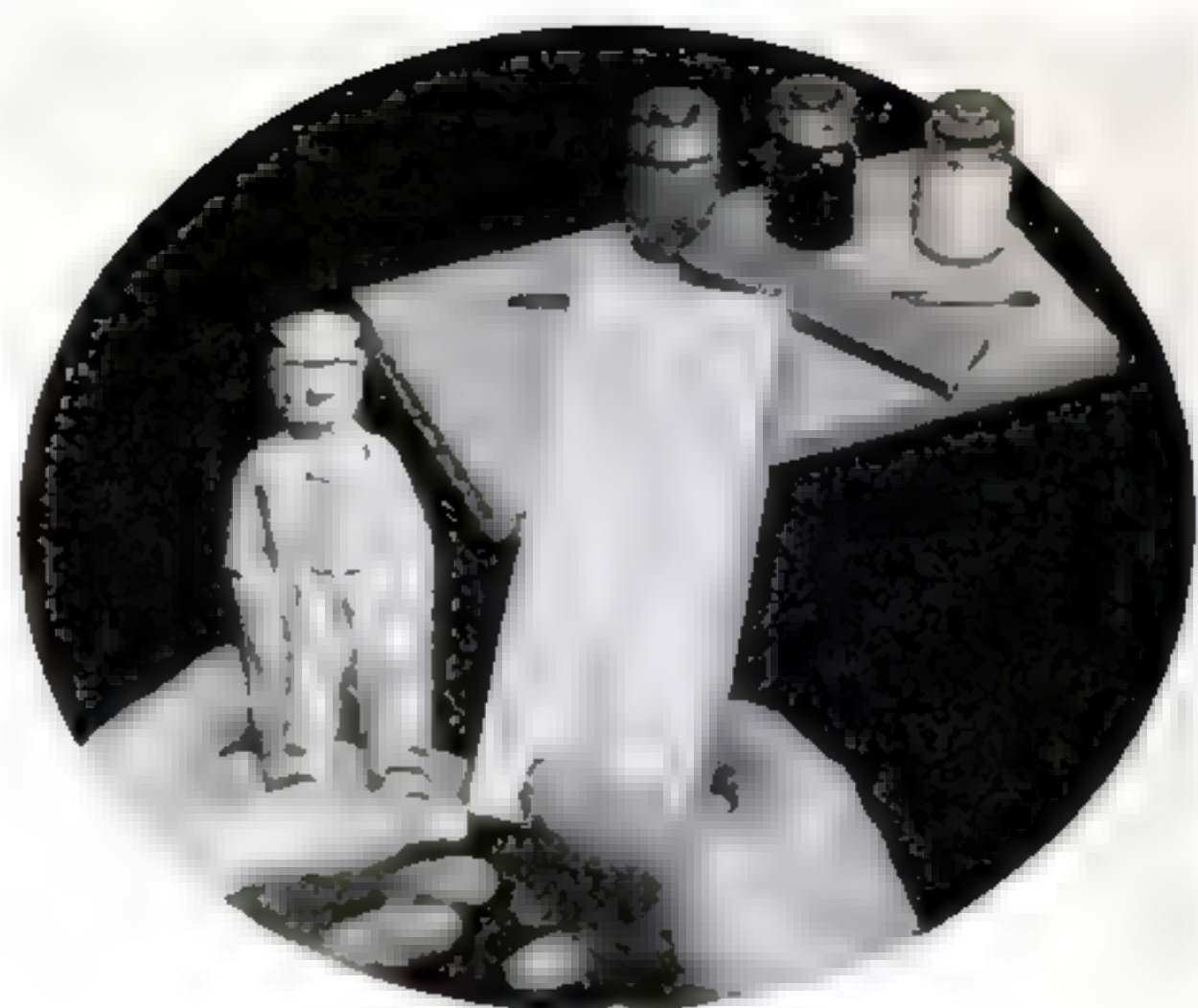
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BECAUSE whittling requires fewer tools than almost any other craftwork hobby, it is an ideal pastime for summer evenings. A sharp pocketknife and a soft pine block are all you need to while away many a pleasant hour at camp, on the beach, or even at home.

For beginners we recommend our special copycraft whittling kit pictured above (No. 10, price \$1.50). This contains a master model

of "Hobo Hank" so that all you have to do is to copy it cut by cut on the stenciled pine block. Also included is sufficient wood for making a desk set, pipe rack, or some other project on which the whittled figure can stand. The figure is 5¾" tall.

A similar kit is available for carving an elephant (No. 11, \$1.50). In addition to the whittling block and the composition model, which is 3½" high, the package contains a special V-shaped carving tool for making the grooves and

wrinkles in the animal's hide.

"Skipper Samuel," a sea captain 5½" tall, has been a favorite with whittlers ever since we first issued the kit four years ago. The kit (No. 7, \$1.50) contains two shaped blocks.

Six different Scottie dogs can be carved with Kit 8 (\$1.00). Each block is approximately ¾" by 2" by 2¼" and is sawed to shape.

For those who like to whittle miniature ships, we suggest our new kit, No. 7M, which contains the raw materials for making nine

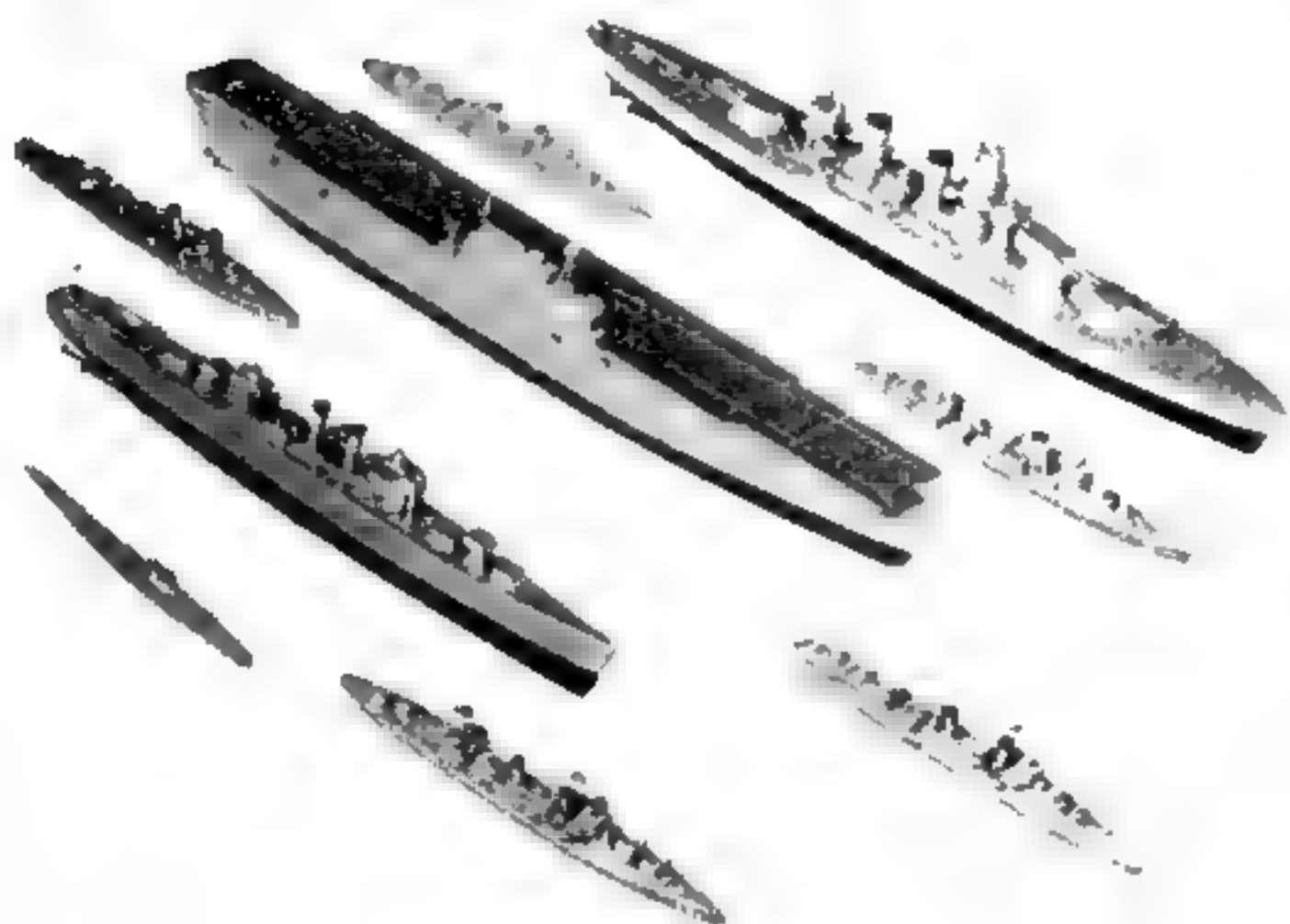
(Continued on page 205)



Kit No. 7

Our Construction Kits

(Continued from page 204)



A miniature fleet of nine war vessels can be made with our new construction kit No. 7M, price \$1.50

models of United States fighting vessels. The price is \$1.50 (25 cents additional west of the Mississippi River and in Canada).

The ships are the superdreadnought *Washington*, light cruiser *Philadelphia*, aircraft carrier *Yorktown*, destroyer flotilla leader *Winslow*, four destroyers similar to the *Mahan* and *Gridley*, and submarine *Pompano*. Designed to a scale of 1" equals 100', the models contain all the important characteristics of their prototypes and are very realistic. The largest ship is the aircraft carrier, which is 8" long; the smallest is the submarine, 3" long. A special knife for cutting balsa wood and a twelve-page booklet containing complete instructions and full-size drawings are included in the kit.

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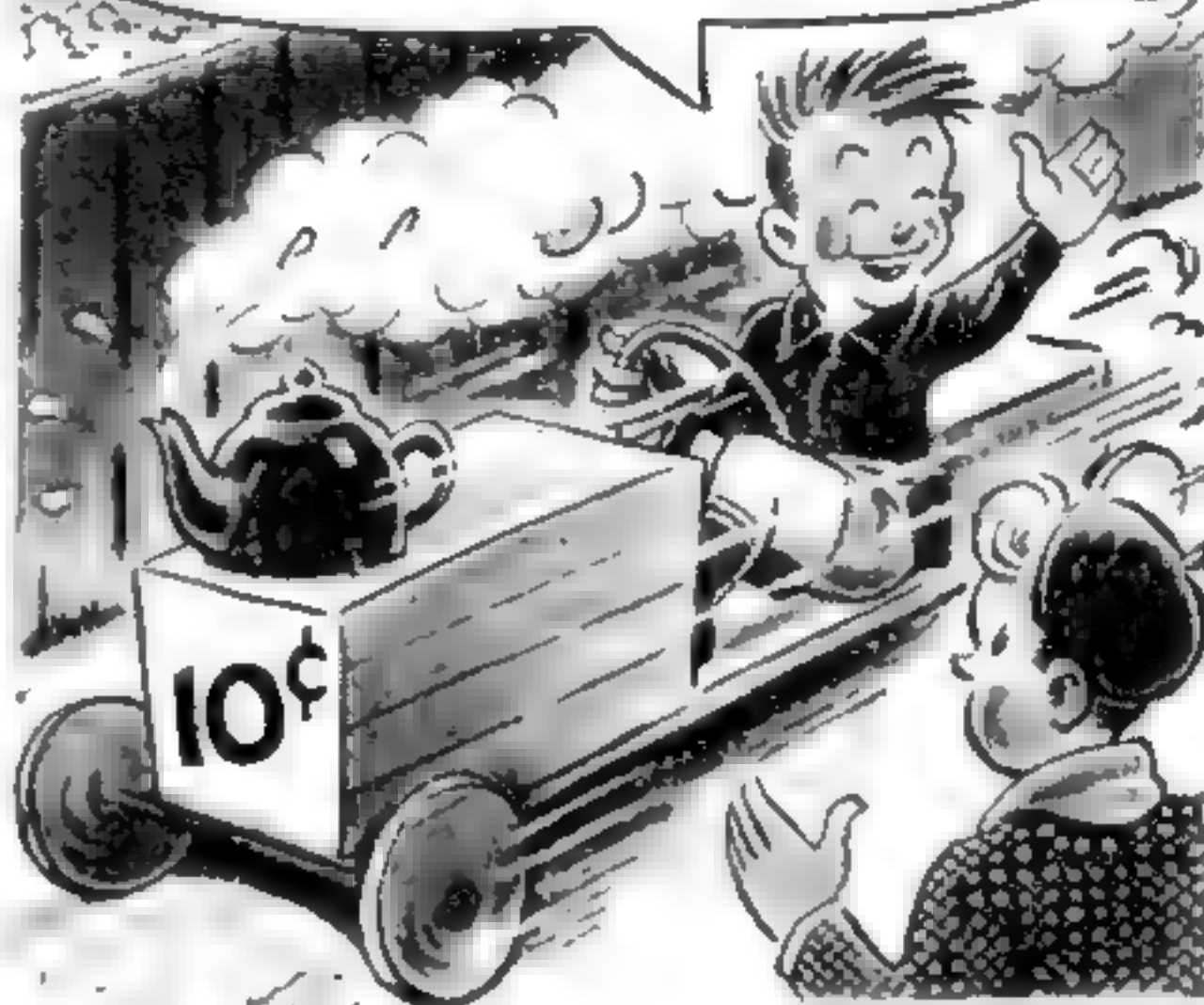
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Darkroom Worktable

MADE FROM OLD PHONOGRAPH



A discarded phonograph cabinet of the console type is easily converted into a darkroom table as above or a small workbench as at the right



AN OLD phonograph cabinet of the console type, which can usually be obtained very reasonably from a secondhand furniture dealer, can be converted into an excellent worktable for the amateur photographer. The spring motor is removed from one side and the record file from the other. A piece of $\frac{3}{4}$ " plywood or other material is screwed on the top. If a piece of $\frac{1}{4}$ " pressed composition wood of hard finish or tempered quality is then fastened over this, it will provide an excellent working surface. A cabinet of this type is equally useful as a light-duty home workshop bench.—WALTER F. DEBOLD.

Cut Films Identified with Bands of Garter Elastic

WHITE garter elastic $\frac{1}{2}$ " wide can be used conveniently for the identification of cut films. Sew the elastic to form bands that will fit the film holders snugly and mark them with India ink to indicate the various kinds of film you use. Then turn them inside out and print "EXPOSED" on all. When you load the holders with more than one variety of films, they can be instantly identified by means of the bands. After exposure, replace the band on the holder inside out, with the "EXPOSED" label visible. This will prevent all danger of making a double exposure.—L. H.



Solutions Filtered Through Lens Tissue



AMATEUR photographers who are particular about the development of their films make it a practice to filter the solutions through a wad of cotton, but they have to exercise much patience while waiting until the liquid drips through. A speedier method is to substitute a sheet of lens-cleaning tissue for the wad of cotton. This is laid over the mouth of the developing tank, and the developer is poured slowly through it. The tissue allows the solution to pass into the tank quite rapidly, yet it holds back all foreign particles provided, of course, that the developer is not poured so fast as to tear the paper.—H. M. N.

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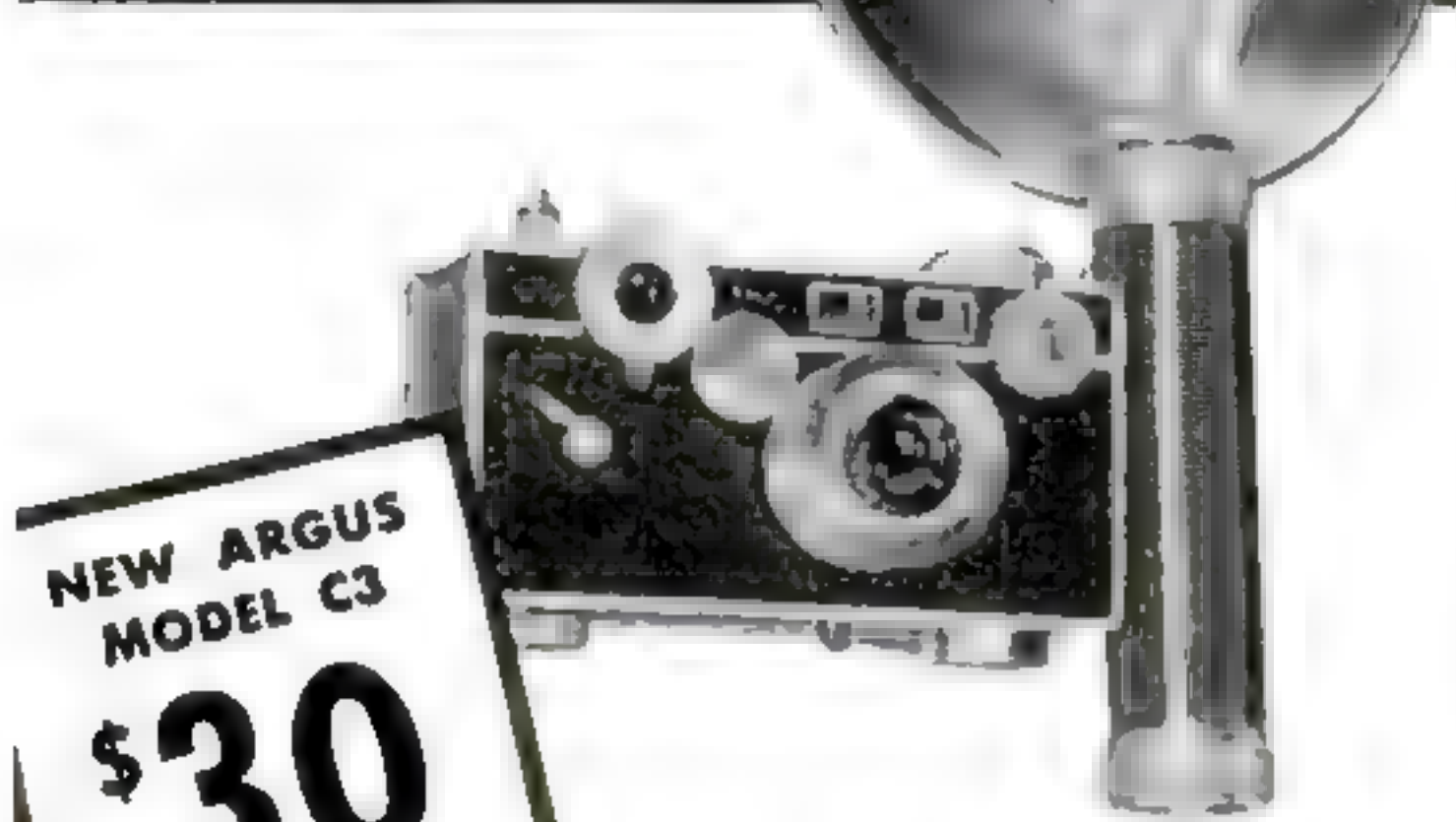
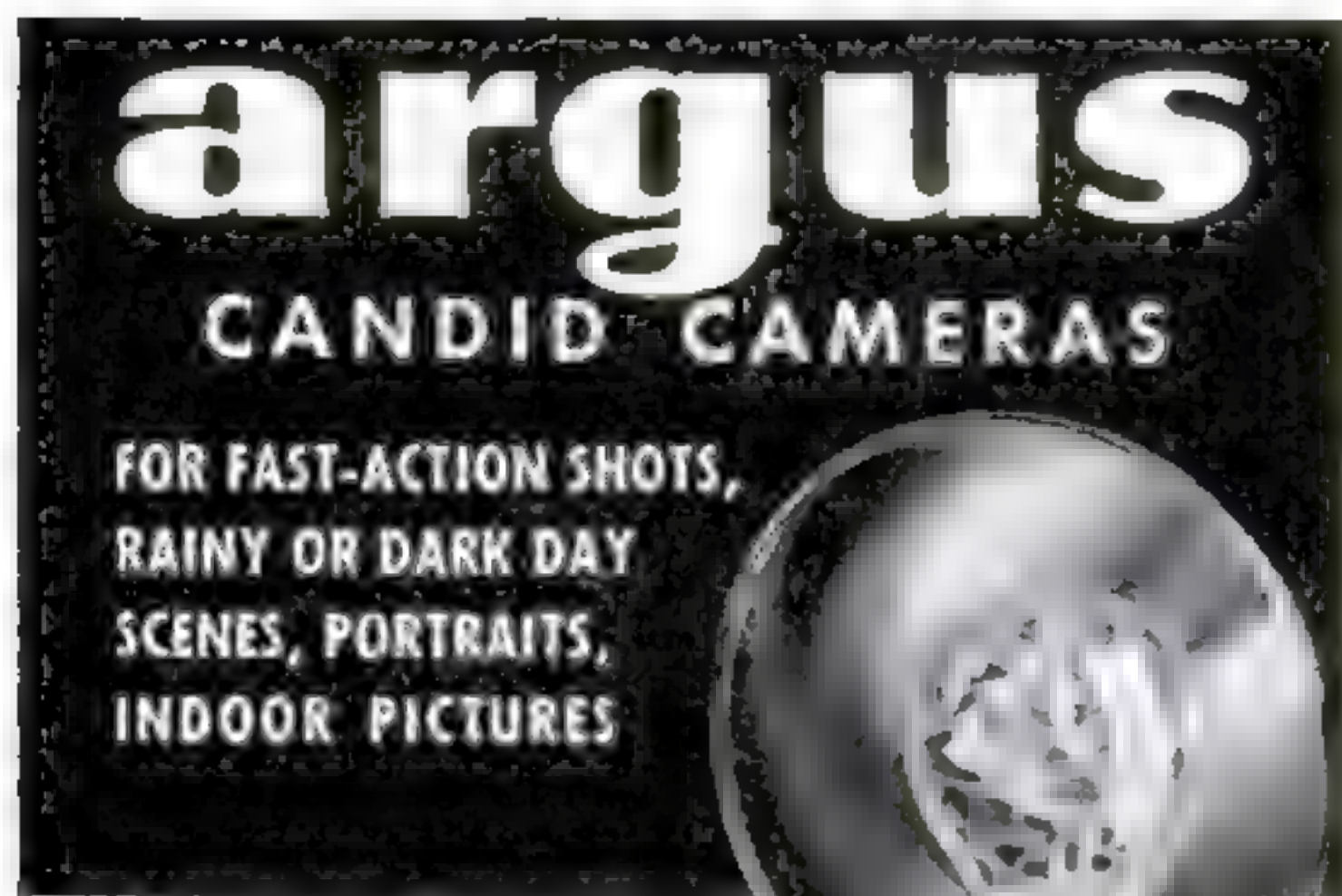
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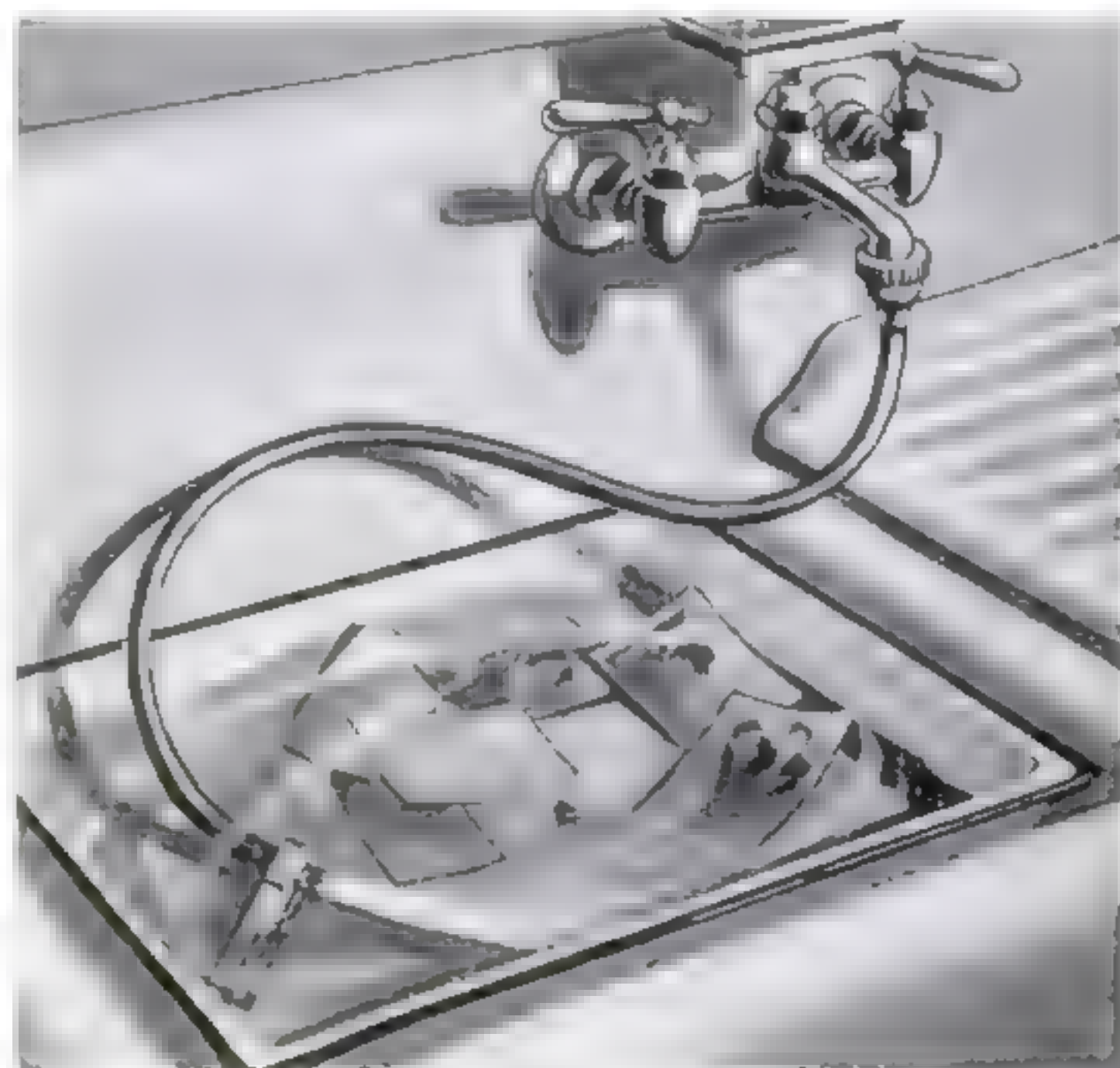


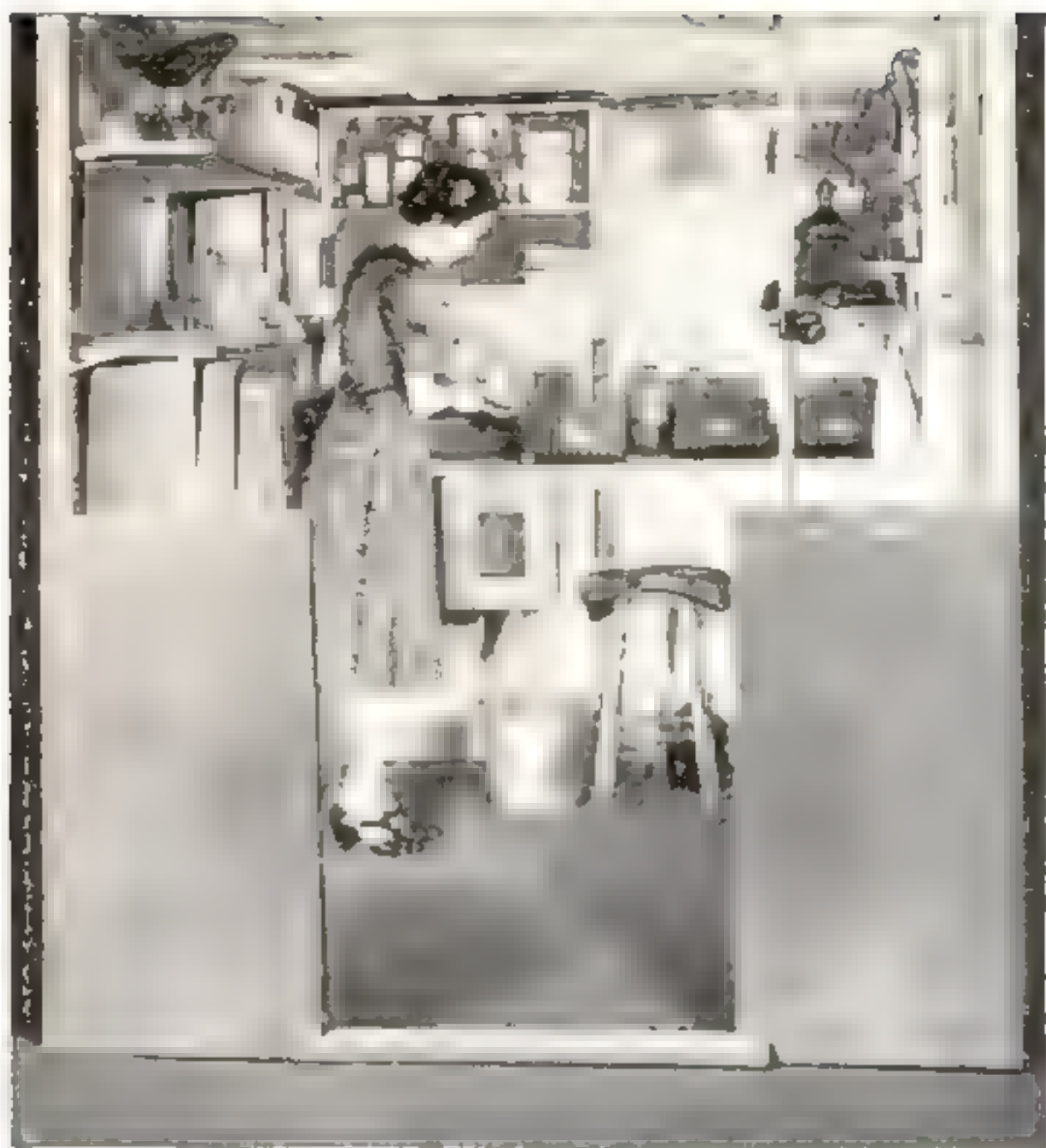
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Clothespin Helps in Washing Prints More Efficiently

SOME amateur photographers use a tray or pan with a section of rubber tubing from the tap to wash their prints. A simple trick that will reduce the water bill and at the same time increase the pressure of the flow into the tray is to clip a spring clothespin on the end of the tubing as shown. This causes the water to flow in a fanlike stream with added force. Prints are kept in motion with considerably less water.—CURTIS MCDOWELL.





Flat Dweller's Darkroom Is Easily Moved

ANY photographer who moves occasionally and wants to take his darkroom with him may build a portable one, as illustrated, from packing lumber and discarded window displays. The upper section and door have been removed to show the interior.

Each side is made in three sections, and each end and the top in two sections, bolted together with roundheaded carriage bolts. The siding is cut from discarded window displays or from large cardboard boxes such as those in which bed mattresses are shipped. The roof or ceiling is made from the plywood of refrigerator boxes, and the door from the same material between strips of $\frac{3}{4}$ " pine.



The corrugated board is overlapped at the joints of the framework to keep out the light

All shelves and cupboards are so placed that they do not overlap onto another section, thereby making it unnecessary to remove them when dismantling the darkroom. The workbench at one end consists merely of a short-legged table resting on the framework of the darkroom. A large, low shelf to the right of the door supports the enlarger and easel and has a drawer beneath. —WALTER HOAG.

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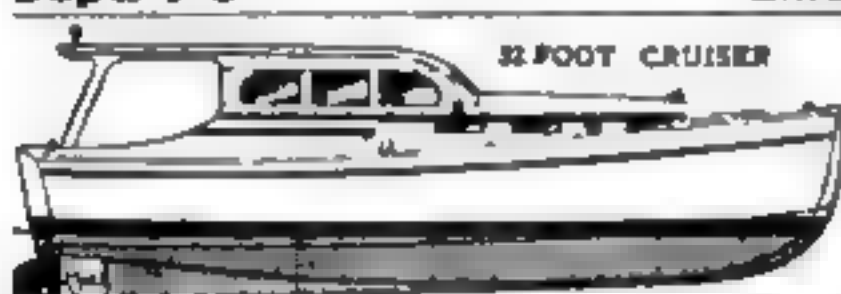
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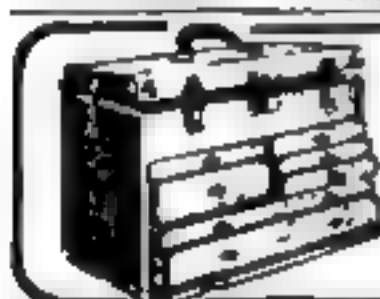
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New Riches from Coal

(Continued from page 41)

nishes, and can also be used for coating fruit and paper and for impregnating wood and textiles.

Rayon making draws upon the Belle plant's output of ammonia for use, together with cellulose, in manufacturing artificial silk by the widely used "cupro-ammonium" process. Going a step farther, a new kind of "super-rayon" dispenses even with the cellulose, being made wholly from coal, air, and water! Stockings have already been woven experimentally from this fabric.

By making alcohol from coal, the Belle chemists create a host of useful synthetic materials. First they produce crude synthetic alcohol, a mixture of different kinds, from the union of hydrogen and carbon monoxide gases. This takes place in converters like those used for making ammonia, but with different temperatures, pressures, and catalysts. Then, by distillation, they separate the various alcohols in pure form.

Methanol, or methyl alcohol, once was produced in this country entirely as a by-product of wood charcoal—hence its more familiar name of "wood alcohol." Synthetic methanol was first manufactured at Belle in 1927, and since then its production has skyrocketed. Antifreeze for automobiles accounts for much of the output. Methanol finds innumerable other uses, in the manufacture of formaldehyde, dyes, inks, chemicals, wood and leather stains, mirrors, and fuels. It is an ingredient of racing fuels that have helped set world speed records.

Distillation also yields alcohols of higher molecular weight. They serve as ingredients of automobile brake fluids, as frothing oils in mineral flotation, as antifoaming agents in refining beet sugar and manufacturing paper, as constituents of special lubricants, and as denaturants for commercial alcohol. One of these alcohols, converted into a solid preparation by a chemical treatment, forms a novel product that has been found to prevent bread from getting moldy.

Thus more than 100 products, running almost the whole gamut of chemical and physical characteristics, are manufactured from three simple raw materials—coal, air, and water. And this may well be only a beginning. No less than 500,000 compounds of carbon are known today, and chemists say the possible total may run into millions of millions! The chemistry of coal is therefore a chemistry of virtually limitless frontiers. Here is new hope and new power for "King Coal" and the 2,500,000 people dependent upon him for their living.

Tigers of the Deep

(Continued from page 94)

its teeth. I pumped the whole magazine into it, and saw Sam refilling his clip with trembling fingers.

Just when we wondered whether we'd live to tell this fish story, Bonnell caught the thrashing brute with a well-placed bullet. Later, I counted twenty-two bullet holes in that shark's body.

But even after that wild experience, I still maintain that the barracuda which infest our southern waters are far more dangerous than sharks. Lithe and muscular, the barracuda boasts a formidable set of 148 teeth, shaped somewhat like a hound's, but thinner and with sharp cutting edges. Its lower jaw is under-shot, with a single fang at its end that locks into a special socket in the upper jaw. Another socket in the lower jaw houses an embryonic tooth that immediately grows as a replacement if the other is accidentally broken off.

The barracuda is a creature of impulse that bites first and reasons why later, if at all. Generally one bite is sufficient for its purpose. Once, while fishing in the Gulf Stream for marlin and sailfish, I threw overboard a foot-long chunk of wood. A lean, gray shape shot up from the depths and I saw the powerful jaws of a large barracuda close over the wood. One lightning bite, and there was nothing left but splinters.

There have been cases where unwary bathers have been suddenly attacked by these wolves of the sea. Before help could arrive, the unfortunate victims suffered frightful lacerations from the fangs of these murderous fish. The barracuda's range, fortunately, is limited to the vicinity of reefs, although they are sometimes seen lying in ambush near docks, or in the shade of overhanging mangrove trees on the Florida Keys.

Ferociousness in fish, however, is not confined to the monsters of the sea, for two of the most dreaded fish in all the world are native to inland rivers. In Africa, the tiger fish which inhabits the Congo River and its tributaries, is dwarfed by comparison with sharks or marlin, but its savage nature, and long, murderous teeth strike terror into the hearts of natives. One sportsman reported hooking one of these tiger fish, which became loose when hauled into the boat, and flopped along the bottom toward the native paddlers. Terrified by the approach of the struggling fish, they instantly plunged overboard. The fact that the river was alive with man-eating crocodiles testifies to their wild fear of this finned demon.

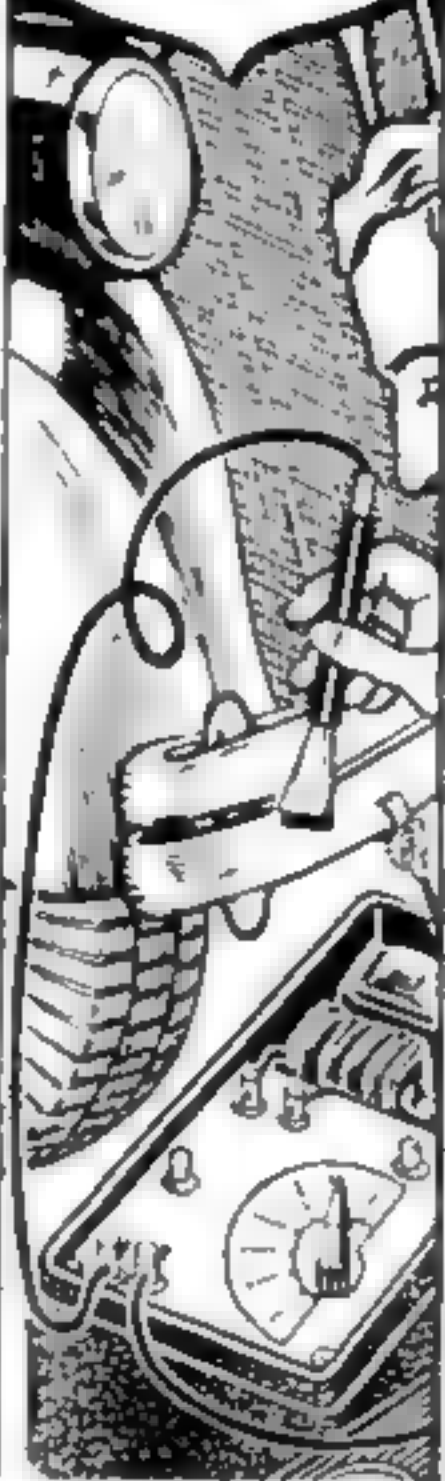
(Continued on page 212)

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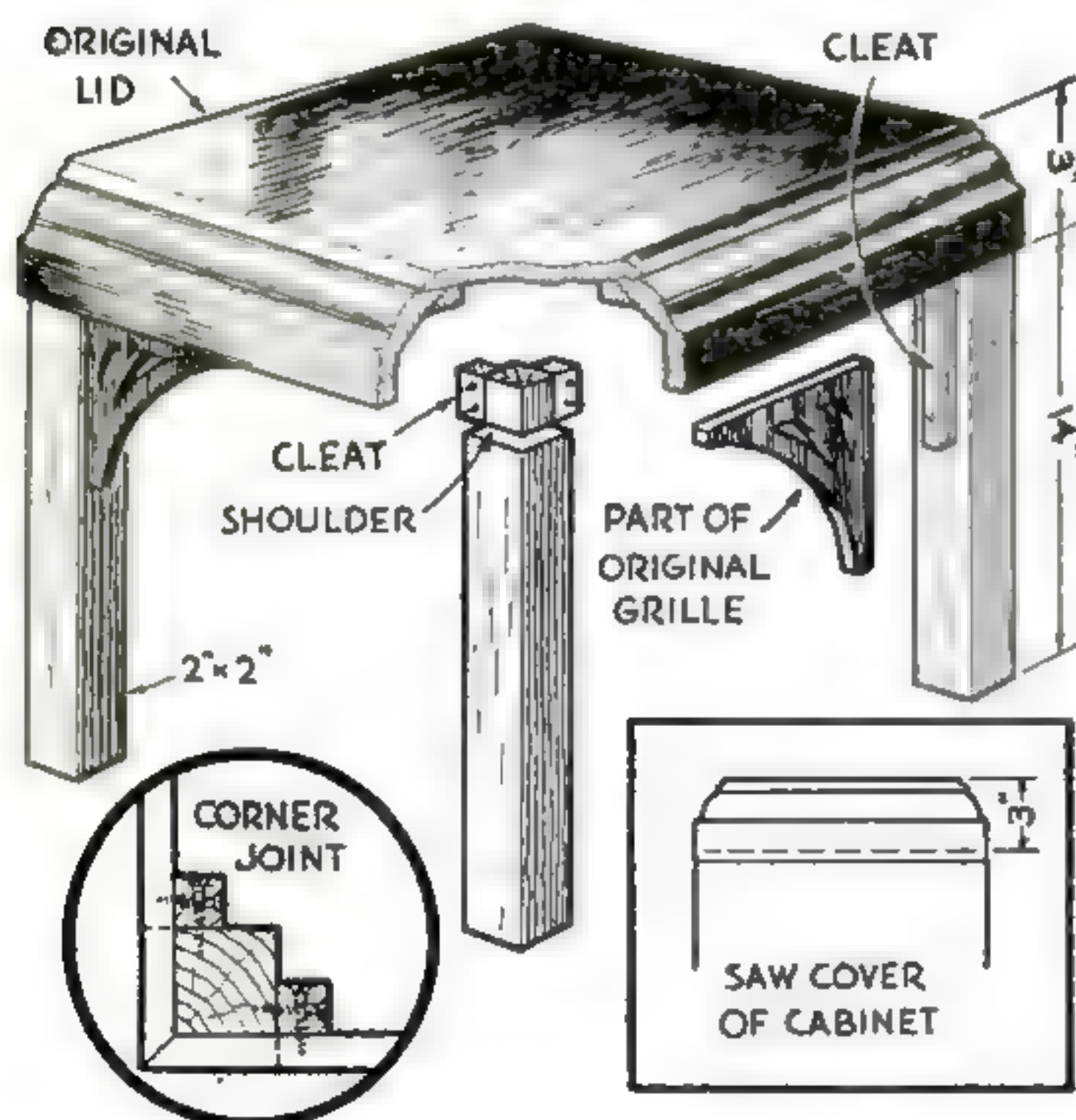
Tigers of the Deep

(Continued from page 211)



Old Phonograph Cabinet Becomes a Coffee Table

MANY an attic contains a discarded phonograph cabinet made of the finest walnut or mahogany. This can be converted into a beautiful coffee table with very little work. The one illustrated, for example, consists of the lid of an old mahogany cabinet with four legs of the same material, braced with eight small brackets cut from the original grille. In this case the lid was cut down to a height of 3". The legs are shouldered as indicated to bring them flush with the apron around the top.—L. R. BROWNE.



The cabinet top is sawed off, mounted on legs, and braced with pieces cut from the old grille

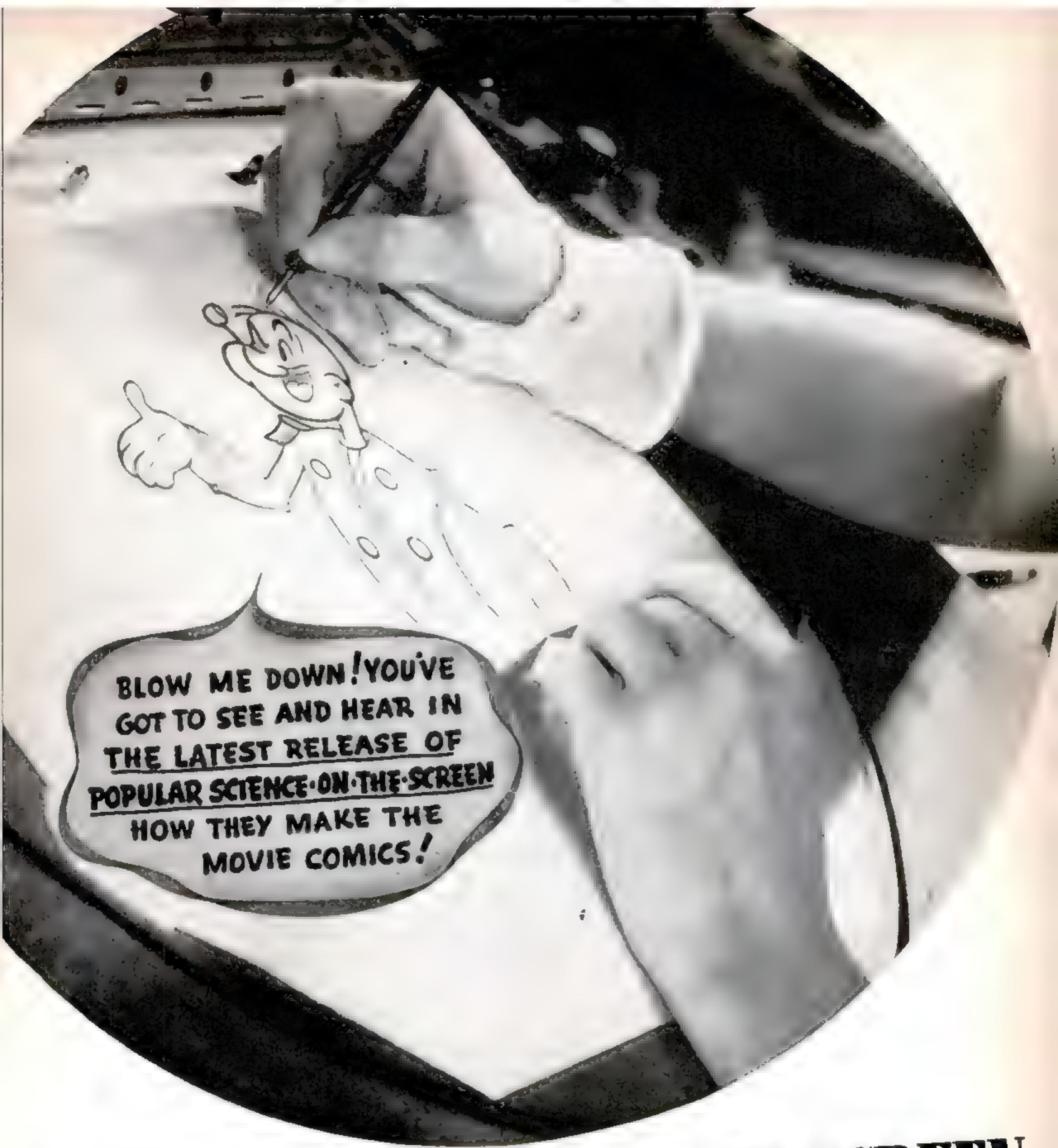
More dreaded than any other living thing on the continent of South America is the piranha, a small river fish weighing only a few pounds, but equipped with sharp teeth and extremely powerful jaws. Traveling in large schools, they do not hesitate to attack, pull down, and consume deer, cattle, or even human beings fording the streams. Blood spilled in the water will attract them instantly. Within a few moments the surface of a placid river will boil with the thrashing, bloodthirsty scramble of a horde of piranha.

But it isn't necessary to leave our own coasts to find this element of ferociousness in comparatively small-size fish, for there is probably no other species more bloodthirsty than our own bluefish. Possessing indomitable courage, great tenacity, and strong jaws, they are only to be trusted when dead. Many fishermen swear that bluefish loose in a boat will do their best to get close enough to bite. I have actually seen unwary anglers removing a hook from an apparently exhausted bluefish, suddenly jump as they felt an arm or leg grasped in the bulldog grip of the fish's jaws. Their teeth, although not long, are extremely sharp, and once those jaws set in a grip, they must be pried apart.

Cautious indeed are the commercial fishermen who throw out small bait from dories to attract bluefish. They are well aware that, should they happen to fall overboard, with fish blood staining their clothes, their chances of rescue would be exceedingly slight. For blues definitely equal the piranha in their bloodthirsty traits. They will attack other fish often far larger than themselves.

Once while fishing off the New Jersey coast, a few miles north of Barnegat, I had a rare opportunity to witness this trait. A large school of bait fish was broiling the surface of an otherwise calm sea. As we slowly approached, we saw that they were being herded along by an encircling school of weakfish. The weakfish in turn were being patrolled by a number of blues weighing not more than three pounds each. The latter would frequently dash in and bite huge chunks of flesh from the bodies of the weakfish, leaving gaping wounds. It was apparent that the bluefish were not driven by hunger, since many of them could not even swallow the great mouthfuls that they tore from their wretched victims.

Among land animals, there are, of course, some that live on weaker species, but there are also many species that live in perfect harmony with each other. Such conditions, however, are unknown in the ocean. Here the law of the survival of the fittest reigns supreme.



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Sidewalk Boat Shop

(Continued from page 109)

so, during the height of the "rowboat rush" in July and August, it is sometimes necessary to build the boat while the customer waits!

With his assistant, Lou Pollack, helping, Faerber can turn out a finished ten-foot skiff in less than an hour and a half. He is known among cabinetmakers as a whirlwind with tools. Not long ago, a man drove up about ten o'clock on a Saturday morning. He was in a great rush to get a boat for use on a summer vacation he was beginning that afternoon. Faerber didn't have in stock the model he desired. But he told him to sit down and smoke a cigar and he would get one for him. The customer watched with amazement while the shavings flew and the boat took shape. In exactly one hour and ten minutes, the craft was finished.

Occasionally, customers arrive with sketches of special boats they want constructed. Last summer, for instance, a Swedish sea captain brought in plans for a midget, ten-foot sailing boat. Faerber built it according to specifications and it functioned so well that a summer camp in New Jersey later ordered half a dozen boats of the same design.

Among Faerber's regular customers are the American Red Cross, the Boy Scouts of America, Pan-American Airways, and the United States Treasury Department. When transatlantic flying boats swoop down at the New York end of their long flight, United States customs officials ride out to board them in rowboats built by Faerber.

Sixty years ago, the basement shop where he works was a grocery store with cabbages and fruit piled up outside. Today, instead of such commonplace produce, Faerber displays his full-size rowboats—the wares of one of the oddest sidewalk stores in America.

POPULAR SCIENCE Question Bee

HERE'S how you figure out your score in the Question Bee on page 118: Compare your results with the list below, in which letters indicate the correct answers to the numbered questions. Give yourself five points for each one you had right. A total of 75 to 85 is good; 90 or better is excellent.

1. b	5. d	9. d	13. c	17. b
2. c	6. c	10. b	14. b	18. c
3. a	7. b	11. b	15. a	19. a
4. c	8. c	12. a	16. d	20. d

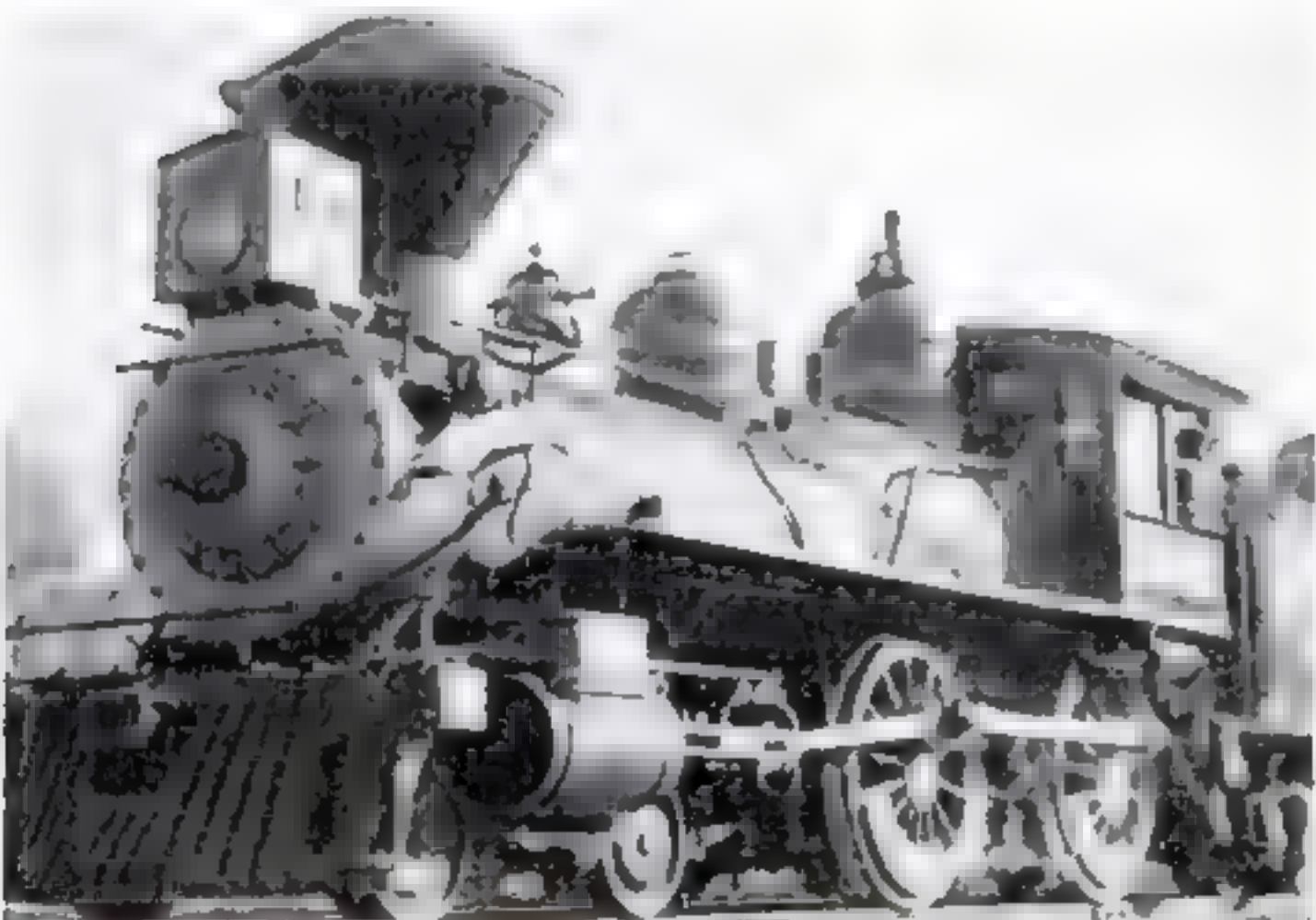


Bas-Relief Photos Made by Using Two Films

BAS-RELIEF photographs can be prepared from almost any good negative. The first step is to make a positive on a slow panchromatic film by contact printing. See that the glass of the contact printer or printing frame is perfectly clean, and make test exposures to determine the correct exposure. The positive for the example illustrated was made on supersensitive panchromatic film with a one-second exposure by using a printing frame and a 250-watt bulb in an enlarger, which was stopped all the way down. Develop to give a density nearly equal to that of the negative.

After fixing, washing, and drying the film in the usual manner, place it over the original negative so that it is slightly off register and fasten it with cellulose tape. This combination is used for the final print, which may be made by contact printing or enlarging on a contrast grade of paper. The amount the films are out of register will govern the results.

If the original negative is smaller than 4" by 5", it is advisable to enlarge for the positive and then make a new negative by contact printing.—A. REX MCGEEHON.



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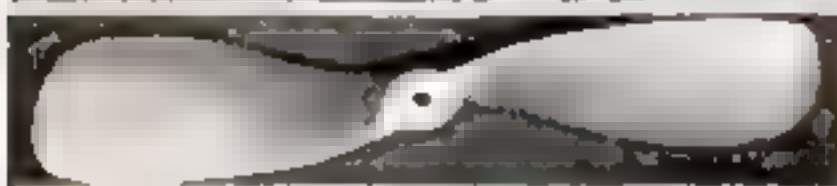
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Gus Wilson Misses a Trick

(Continued from page 124)

gas in proportion to the air. That loaded the cylinders and made the engine hold back and miss, and finally cut out. You're pretty good, Mr. Devoe!"

"No I'm not," Devoe disclaimed, with unusual modesty. "It was just a brain wave. I happened to hit it right. 'Fools rush in where angels fear to tread.' I don't know a thing about engines. I'm an artist—not a mechanic. Well, how much do I owe you?"

"You don't owe me anything," Gus said. "When I don't do a job, I don't charge for it. Good-bye!"

Several customers and friends of Gus and Joe gathered in the office of the Model Garage that evening. They found Gus unusually quiet—so much so that after a half hour George Knowles asked him why.

Gus told them about Montgomery Devoe and his chrome-plated roadster. "I don't mind missing a trick now and then," he concluded. "We all do it. But it sort of stings to be shown up by a lily-handed movie star!"

Joe Clark got up and began digging through a pile of magazines on a table in the corner. "I was reading something about Montgomery Devoe only the other day," he said. "In the gossip department in one of the movie magazines. Wait a minute—yes, here it is. Listen:

"Montgomery Devoe, debonair star of 'Big Town Glamour,' 'False Evidence,' and various other silk-hat and tail-coat dramas, is one of the several Hollywood headliners who live in constant fear of their pasts finding them out. The sleek and aristocratic Devoe has a past which wasn't lurid, but which was strictly plebeian—in his case much worse from a publicity point of view. He used to be an automobile mechanic back in Detroit—a good automobile mechanic—and his first job in Hollywood was keeping the automobile fleet of one of the big producing companies in running order. Now, in his day of fame, he disclaims all knowledge of automotive machinery—even to the chauffeur who takes care of his three expensive cars.'"

Gus looked puzzled for a minute, and then laughed. "Montgomery Devoe—Mike Davoli," he said. "I knew I'd seen that guy somewhere, and I was pretty sure it hadn't been on the screen. Why, we worked in the same shop one time—my last job, almost, before I settled down. Bet he knew me, too, and is having a big laugh over the way he showed me up. Mike always was a fresh kid—but he was a darned good mechanic!"

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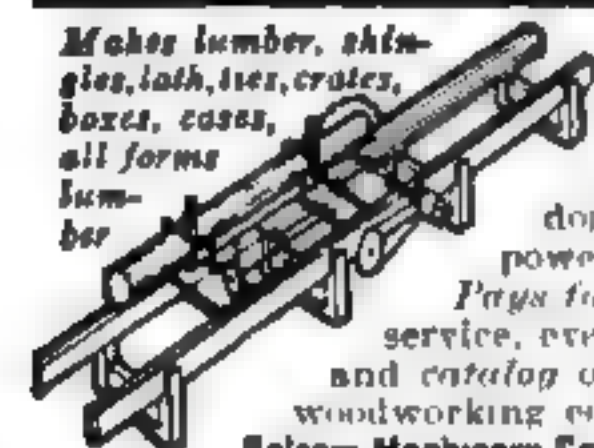
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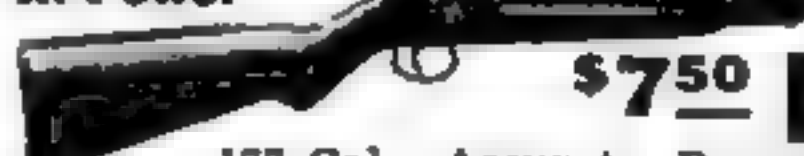
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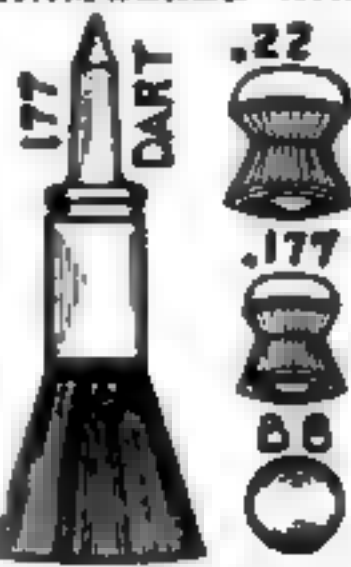
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Analyzing Soft Drinks

(Continued from page 183)

more than a tablespoonful), and then pour the liquid into a small porcelain evaporating dish. This concentrated solution, which contains the caffeine, should now be evaporated to a dry residue.

A beaker of boiling water will serve as a water bath for this purpose, the evaporating dish being left on top of the beaker until drying is complete. Or you can use the electric-light evaporator illustrated and described in an item accompanying this article.

When the residue in the evaporating dish is dry, hold the bottom of a flask over it, and heat the evaporating dish directly with a Bunsen burner. This will volatilize the caffeine in the residue. The compound "sublimes" or passes directly from a solid to a vapor, and will condense as a white deposit on the cool under surface of the flask.

To identify the white compound as caffeine, invert the flask and add a drop of strong hydrochloric acid to the white sublimate or deposit upon it. Next add a crystal of potassium chlorate to the drop of acid. When you no longer perceive the acrid odor of chlorine, warm the crystal and surrounding liquid by wafting a blue Bunsen flame across them. A red coloration will appear. Add a drop of ammonium hydroxide, and it turns purple. The color disappears on adding one or two drops of potassium hydroxide solution. These color changes prove the compound is caffeine. A compound may still contain caffeine if the test is negative—for example, it does not work well with the residue obtained by concentrating the cola drinks. But the murexide test gives strikingly positive results if you perform it upon tea, as just described.

Tannic acid, also known as tannin—another compound found in tea—is even easier to detect. You can also show that the longer tea is brewed, the more tannic acid it contains. Make an extremely pale tea, by stirring some tea leaves in a beaker of very hot water. Place five cubic centimeters of this pale tea in a test tube, letting the rest continue to brew meanwhile. After a minute, remove another portion of five cubic centimeters and place it in a second test tube. Repeat this procedure at intervals until the last portion is one of really strong tea.

Now add a drop of ferric (iron) chloride to each of the test tubes, and shake it. The iron chemical reacts with the tannic acid to form iron tannate, which is basically an ink. The liquid will be darker in each succeeding test tube, which is thus shown to contain more tannin than the one before, containing the weaker brew.



Old Bill Says

USE extreme care not to drop a heavy chuck or any bulky work on a machine-tool bed. You won't break anything, but what a scraping job there would be for someone!

When using solder on steel, give the preference to a nonrusting flux such as a mixture of 6 oz. alcohol, 2 oz. glycerin, and 1 oz. zinc oxide.

Before fitting and brazing a tungsten-carbide tip to its holder, make sure that the shoulder is long enough for convenience in grinding as the bit becomes shorter.

By slitting a solid button die with a 1/16" cut-off wheel and grinding a vee, you can make the die adjustable.

After sharpening the end teeth of an end mill, stand it on end on a perfectly flat surface. If the mill rocks, it won't cut well.

Don't forget that a high-speed steel milling cutter when worn to such an extent as to be useless, is worth about twenty cents a pound as scrap. If it can be salvaged by grinding new teeth, its value goes up to about four dollars a pound.

A good cement is always appreciated in the shop. Here is a reliable formula: four parts of the best glue, four parts of black rosin, and one part of red ocher. Use very little water for mixing. It will even cement leather to iron.

Steel making is always advancing. There is a new die steel available that can be air cooled and gives a reading of 100 inch-pounds greater than oil hardening steels at 60 Rockwell C. It has a machineability rating of 74 Rockwell C.

When the lands on the teeth of a milling cutter exceed 3/32", a secondary clearance of 12 to 15 deg. will increase the cutting efficiency of the tool.

On the average, a 1 1/2" high-speed steel drill is intended for at least 250 resharpenings. The actual number, of course, depends upon the material, how many holes are drilled between grinds, and the like.

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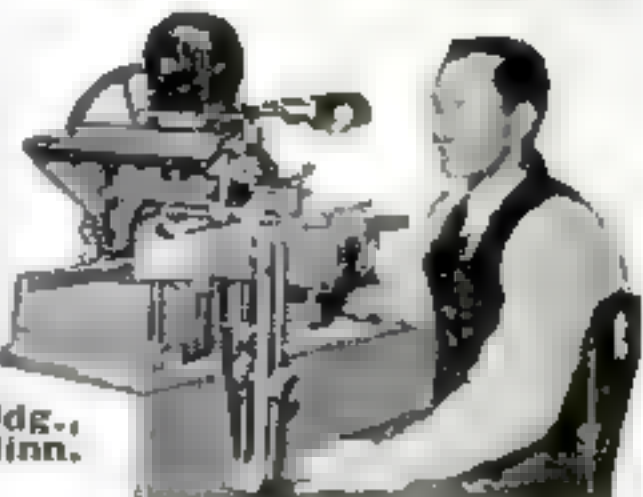
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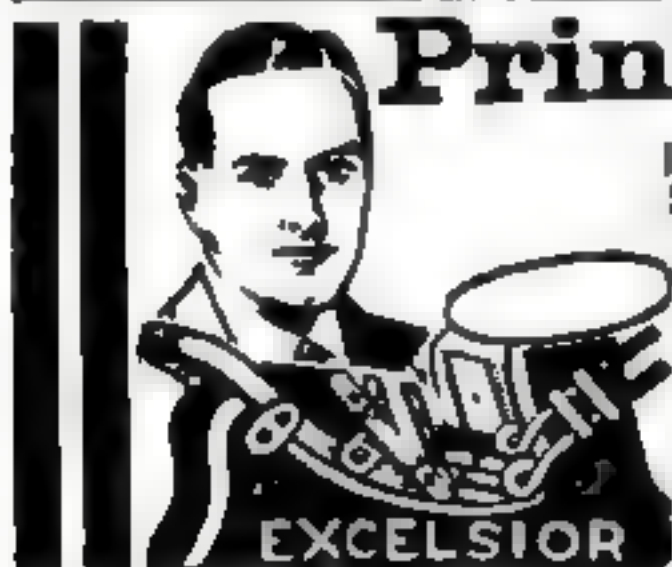


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Your Microscope Reveals Jungles on Stale Bread

(Continued from page 189)

outside of bacteriology, there is a place for such work, since much waste of food and much disease in plants and animals result from the growth of funguses. Among the routine work of microanalysts attached to the U. S. Department of Agriculture is the identification of molds growing in canned tomatoes and other foods.

Although you can obtain an abundance of specimens of bread mold and similar forms by easy culture methods, there always is the temptation to try making permanent mounts of such material. It happens that molds are very delicate forms of plant life when it comes to fixing and mounting them, and have a disgusting tendency to shrivel up and lose their original shape. However, with the aid of dioxan, molds and other delicate structures can be mounted in balsam with hardly any distortion, in many cases none that can be detected.

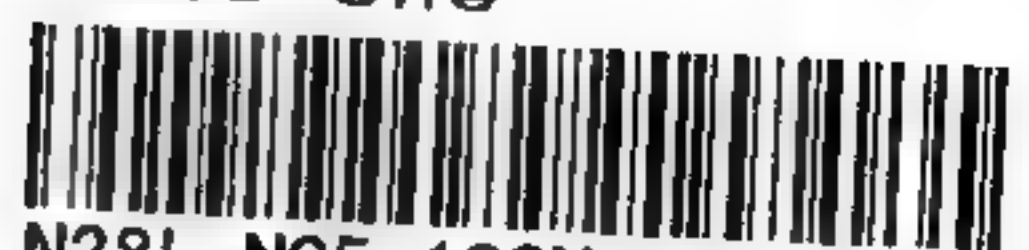
First, it is necessary to fix the mold so that it will retain its form during subsequent handling. To do this, prepare a fixative by mixing ten cubic centimeters (three teaspoonfuls) of distilled water with the same amount of dioxan, one cubic centimeter of formalin, and one cubic centimeter of acetic acid. This is similar to a dioxan fixative devised for the purpose at the Oregon Experiment Station.

Let the mold remain in the solution for fifteen minutes or longer, up to about an hour. Then remove it and place it in pure dioxan. In the center of a clean slide place a drop of Canada balsam and over it flow five or six drops of dioxan. Mix thoroughly with a dissecting needle, until you can see no streaks that indicate undiluted balsam. Transfer the mold from the dioxan bath to the dioxan-thinned balsam. Although you can add the cover glass immediately, it is better to place the slide in a dustless place and let some of the dioxan evaporate. When the balsam has thickened, and incidentally decreased in volume, add the cover. If the thinned balsam seems insufficient in volume to fill the space under the cover, you can make a ring around the specimen with thicker balsam before applying the cover glass.

The use of stains will accentuate the structure of mold mycelia and other elements. To stain when the above method is employed, transfer the specimen from the fixative to a solution of the stain in equal parts of water and dioxan. After a time that depends on the stain used, transfer to pure dioxan, and then proceed as already explained.

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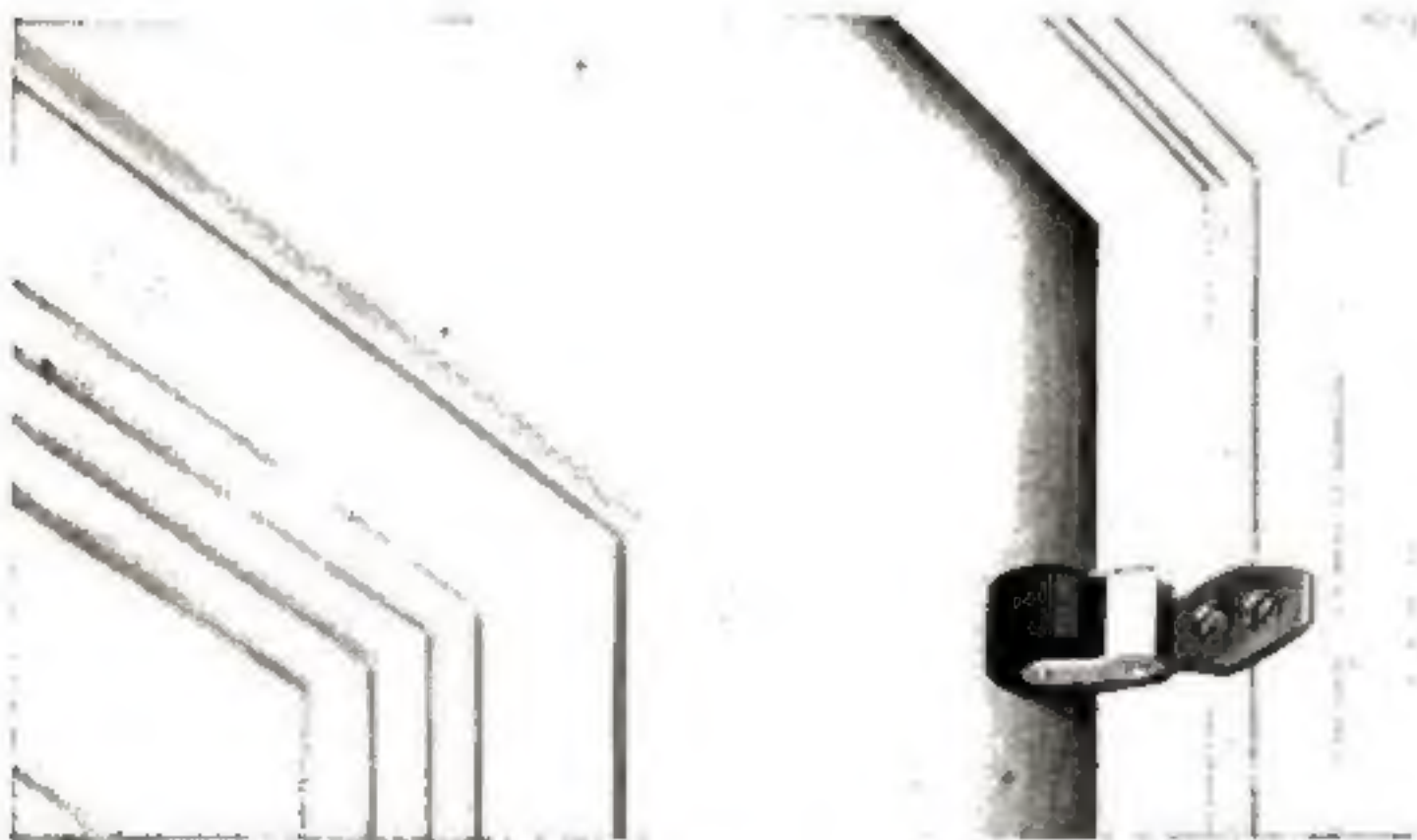


Treating Costume Jewelry

INEXPENSIVE costume jewelry often has a tendency to leave green tarnish stains on the skin. To overcome this, coat the jewelry, before wearing, with clear or colorless nail polish.—WILLIAM SWALLOW.

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